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MOBILE RADIO

MASTR
PROGRESS LINE
Professional Series

MAINTENANCE MANUAL

MOBILE RADIO

CONTROL UNIT

132-174 MHz,
30- and 90-Watt

TWO-WAY FM MOBILE COMBINATIONS

LBI-3500F

SPEAKER

GENERAL ELECTRIC

MOBILE RADIO

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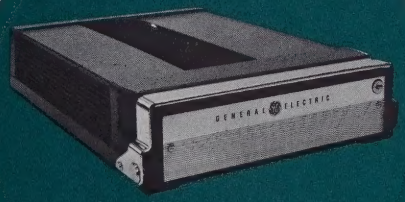

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WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

EQUIPMENT INDEX

EQUIPMENT	MODEL OR TYPE NUMBER
30-Watt Transmitter	ET-57-A, B, C
90-Watt Transmitter	ET-58A thru K
Receiver	ER-41-A, B, C & E
Control Unit	EC-59-A
30-Watt Power Supplies	
12-Volt	4EP37B10
6/12-Volt	4EP37C10
12/28-Volt	4EP37D10
80-Watt Power Supply	4EP37A10
Five-Watt Speaker	4EZ20A10
Microphone	4EM25A10
132—470 MHz Roof-Mount Antenna	4EY12A13
Fuse Assembly	
12-Volt, Medium Power	19B216021-G2
12-Volt, High Power	19B216021-G3
Fuse & Relay Assembly	
6-Volt	7487952-G20
28-Volt	7487952-G19
Mounting Frame	19C303430-G1
Mounting Hardware	
Trunk Mount	19A121626-G2
Front Mount	19A121626-G5
Battery Cables	
12- or 28-Volt	7147499-G6
6-Volt	7147499-G5
Trunk-Mount Power Cable	
12-Volt	19C303601-G2
6-Volt	19C303606-G1
28-Volt	19C303603-G2
Front-Mount Power Cable	
12-Volt	19C303601-G1
6-Volt	19C303607-G1
28-Volt	19C303603-G1
Trunk-Mount Control Cable (18-Foot)	
One-Frequency	19C303626-G1
Multi-Frequency	19C303626-G3
Ignition Switch Cable	
12-Volt	19A121454-G1
6- or 28-Volt	19A121454-G2
Microphone Bracket	7141414-G2
Key	5491682-P8
Alignment Tools	
Hex Slug Type	4038831-P2
Slotted Screw Type	4033530-G2
OPTIONS	
Trunk-Mount Spacer Kit, Option 7082	19A121884-G1
23-Foot, 12-Volt Power Cable, Option 7083	19C303601-G3
23-Foot Control Cable	
One-Frequency, Option 7084	19C303626-G2
Multi-Frequency, Option 7085	19C303626-G4

SPECIFICATIONS*

DIMENSIONS (H x L x W)				
Trunk Mount	3-7/8" x 19" x 13-1/2"			
Front Mount	3-7/8" x 19-7/8" x 13-1/2"			
WEIGHT (Approx.)	52 Pounds			
BATTERY DRAIN	30 WATTS			90 WATTS
	At	At	At	At
Receiver	13.8 VDC	6.6 VDC	28 VDC	13.8 VDC
Standby (Squelched	150 mA	2.1 amps	450 mA	150 mA
Full Audio (5-Watts)	1.1 amps	3.9 amps	1.3 amps	1.1 amps
Transmitter Filaments On (Squelched)	1.2 amps	4.8 amps	1.25 amps	1.9 amps
Transmitter	At	At	At	At
	13.8 VDC	6.4 VDC	28 VDC	13.8 VDC
	12 amps	23 amps	5.5 amps	26 amps
DUTY CYCLE	Transmit: 20% (one minute on, four minutes off) Receive: Continuous			
OPERABLE TEMPERATURE RANGE	-30°C (-22°F) to +60°C (+140°F)			

*These specifications are intended primarily for use by the serviceman. Refer to the appropriate Specification Sheet for complete specifications.

COMBINATION NOMENCLATURE

1st Digit	2nd Digit	3rd Digit	4th Digit	5th Digit	6th Digit	7th Digit	8th & 9th Digits
Mechanical Package	Operating Voltage	RF Power Output Range	Channel Spacing	Mounting	Number of Freq.	Options	Frequency Range
M Mobile Unit	**T** 12-VDC unit	**5** 16-38 watts	**6** 30 kHz	**T** Trunk-Mount Mobile	**A** 1-Freq.T 1-Freq.R	**S** Standard	**55** 132—150.8 MHz
	A 6/12-VDC unit with 6-V cables	**6** 38-64 watts	**9** 60 kHz	**F** Front-Mount Mobile	**B** 2-Freq.T 1-Freq.R	**U** Channel Guard	**66** 150.8—174 MHz
	E 6/12-VDC unit with 12-V cables	**7** 64-128 watts			**C** 2-Freq.T 2-Freq.R	**W** Channel Guard & Noise Blanker	
	U 28/12-VDC unit with 28-V cables				**D** 1-Freq.T 2-Freq.R	**P** UHS Receiver	
	J 28/12-VDC unit with 12-V cables				**E** 3-Freq.T 3-Freq.R	**G** UHS Receiver & Channel Guard	
					F 4-Freq.T 4-Freq.R	**N** Noise Blanker	

DESCRIPTION

General Electric MASTR Progress Line Mobile Radio Combinations are attractively styled, ruggedly constructed units that are designed to meet the most stringent requirements in the field of two-way FM radio.

The MASTR combination is contained in a "slide-rail" mounting frame and is designed for either Front-Mount or Trunk-Mount installations. The radio is tamper-proof when locked in the mounting frame. When unlocked, the unit can be easily pulled out of the frame for servicing.

Both the transmitter exciter board and the receiver are fully transistorized. Silicon transistors are used throughout for added reliability.

SERVICING

The MASTR transmitter, receiver and power supply consists of one-piece modules that can be easily removed from the splash-proof mobile case. All major modules and tuning adjustments are accessible from the top of the unit.

Both the transmitter and receiver are equipped with centralized metering jacks for simplified alignment and troubleshooting.

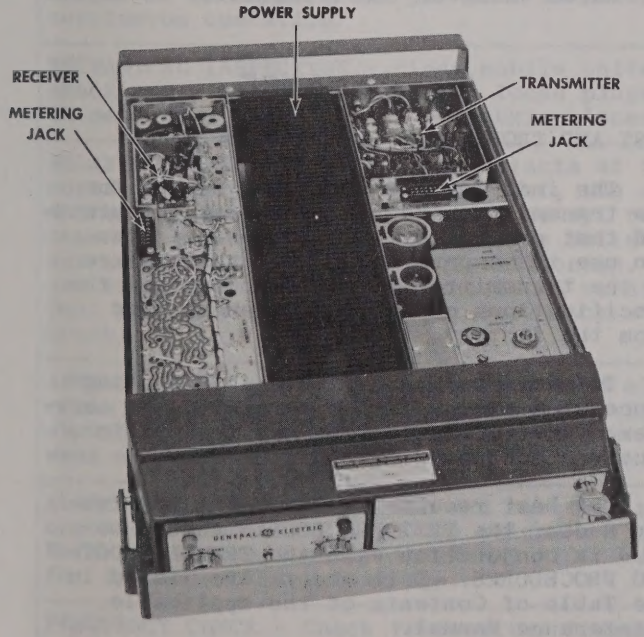


Figure 1 - Module Layout for MASTR Progress Line

The transmitter and receiver modules may be used interchangeably in mobile and station installations. No modifications are required when transferring the units from one type of operation to another.

TRANSMITTER

The transmitter assembly consists of the transistorized exciter board and the power amplifier section. The 30-watt transmitter used only two tubes in the power amplifier: the 90-watt transmitter used only three tubes. The standard transmitter may be equipped with:

- One through four frequencies
- Channel Guard (tone squelch)

RECEIVER

The fully transistorized receiver is completely contained in an aluminum casting, which provides excellent electrical shielding and reduces the effects of vibration. The standard receiver may be equipped with:

- One through four frequencies
- Channel Guard (tone squelch)
- Noise Blanker

POWER SUPPLIES

Four different transistorized power supplies are available for MASTR mobile combinations. In the medium power range (30-watt), power supplies are available for the following positive or negative ground vehicles systems:

- 12-Volt
- 6/12-Volts
- 12/28-Volts

The high power 90-watt supply will operate in a 12-volt positive or negative ground vehicle only.

CONTROL UNITS

The Control Unit is used for both Front-Mount and Trunk-Mount installations. In Front-Mount applications, the Control Unit is attached to the front panel of the two-way radio. In Trunk-Mount applications, the Control Unit is mounted on the underside of the instrument panel near the operator.

INITIAL ADJUSTMENT

After the MASTR Two-Way Radio has been installed (as described in the INSTALLATION Manual), the following adjustments should be made by an electronics technician who holds a 1st or 2nd Class FCC Radio-telephone license. Alignment tools are provided with the radio.

Make sure that a RADIO TRANSMITTER IDENTIFICATION form (FCC Form 452-C or General Electric Form ECP-82) has been filled out and attached to the transmitter.

TRANSMITTER ADJUSTMENT

The initial adjustment for the transmitter includes loading the power amplifier into the antenna, and checking the frequency and modulation. For the Initial Adjustment procedure, refer to the ALIGNMENT PROCEDURE in the MAINTENANCE MANUAL for the transmitter.

NOTE

Battery polarity must be observed when the Two-Way radio is installed. No damage will occur to the unit if the Power Cable connections are accidently reversed, as long as the unit is not keyed. However, connecting the yellow and black Ignition switch leads to the wrong polarity will cause the in-line fuse in the yellow lead to blow. Always check to see if the receiver is operating properly before keying the transmitter.

RECEIVER ADJUSTMENT

The initial adjustment for the receiver includes zeroing the receiver to the system operating frequency, and matching the antenna transformer to the antenna. For the Receiver Initial Adjustment Procedure, refer to the FRONT END ALIGNMENT PROCEDURES in the MAINTENANCE MANUAL for the receiver.

OPERATION

Complete operating instructions for the Two-Way Radio are provided in the separate OPERATOR'S MANUAL (LBI-3525). The basic procedures for receiving and transmitting messages follows:

TO RECEIVE A MESSAGE

1. Turn the radio on by turning the STBY-ON-OFF switch to the STBY (Standby) position if you are not expecting any calls but wish to monitor other calls, or to the ON position if you expect to have to answer calls. The green light stays off in the STBY position to save battery power.

2. Turn the SQUELCH control clockwise (to the right) as far as possible.

3. Adjust the VOLUME control until the "hissing" sound is easily heard, but is not annoyingly loud.

4. Now, slowly turn the SQUELCH control counterclockwise (to the left) until the "hissing" sound just fades out.

The radio is now ready to receive messages from other radios in the system.

TO TRANSMIT A MESSAGE

1. Apply power to the transmitter by turning the STBY-ON-OFF switch to the ON position. Let the unit warm up for 30 seconds.

2. Press the push-to-talk button on the microphone and speak across the face of the microphone in a normal (or softer) voice. Release the button as soon as the message has been given. The red signal light on the control panel will glow each time the microphone button is pressed, indicating that the transmitter is on the air. The receiver is muted whenever the transmitter is keyed.

MAINTENANCE

TEST AND TROUBLESHOOTING PROCEDURES

The individual Maintenance Manual for the transmitter and receiver describe standard test procedures which the serviceman can use to compare the actual performance of the transmitter or receiver against the specifications of the unit when shipped from the factory.

In addition, specific troubleshooting procedures are available to assist the serviceman in troubleshooting the transmitter, receiver and power supply.

For best results in servicing the Two-Way Radio, the TEST PROCEDURES should be used in conjunction with the TROUBLESHOOTING PROCEDURES. Both sheets are listed in the Table of Contents of the applicable Maintenance Manual.

NOISE SUPPRESSION

After completing the initial adjustment of the transmitter and receiver, the serviceman in identifying and eliminating undesirable noise interference.

PREVENTIVE MAINTENANCE

To insure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts at regular intervals. This preventive maintenance should include the maintenance checks listed.

Ignition Noise

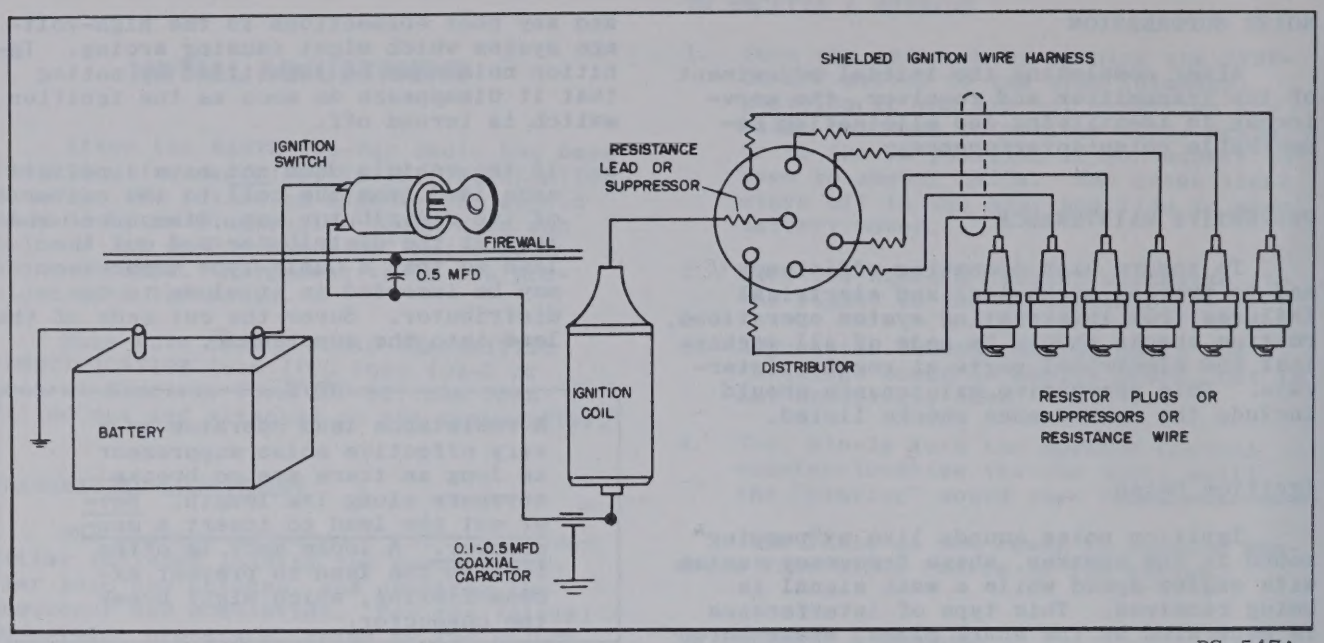
Ignition noise sounds like a "popping" sound in the speaker, whose frequency varies with engine speed while a weak signal is being received. This type of interference is generated by the spark plugs, distributor and any poor connections in the high-voltage system which might causing arcing. Ignition noise can be identified by noting that it disappears as soon as the ignition switch is turned off.

1. If the vehicle does not have a resistance lead from the coil to the center of the distributor cap, disconnect the lead at the distributor and cut the lead so that a Cable-Type Suppressor may be inserted in it close to the distributor. Screw the cut ends of the lead into the suppressor.

NOTE

A resistance lead operates as a very effective noise suppressor as long as there are no breaks anywhere along its length. Never cut the lead to insert a suppressor. A loose knot is often tied in the lead to prevent excess flexing, which might break the conductor.

MAINTENANCE CHECKS	INTERVAL	
	6 Months	As Required
CONNECTIONS - Ground connections and connections to the voltage source should be periodically checked for tightne s. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation.	X	
GENERATOR AND REGULATOR - The generator and voltage regulator should be maintained periodically to keep the generating system within safe and economical operating limits. If generator voltage is excessive, tube, lights, etc., may burn out prematurely. This condition is indicated when the battery loses water rapidly. Usage of 1 or 2 ounces of water per cell per week is acceptable for batteries in continuous operation.		X
MECHANICAL INSPECTION - Since mobile units are subject to constant shock and vibration, check for loose plugs, nuts, screws, and parts to make sure that nothing is working loose.	X	
RELAY CONTACTS - Examine the contacts of the relay. Where relay contacts carry little or no current, the contacts do not clean themselves and an insulating coating is apt to form. When contacts become coated, remove the film with a suitable solvent applied with a non-metallic brush, such as a toothbrush. Current-carrying contacts are subject to pitting and should be burnished from time to time. Dust and particles should be removed by a clean, dry, non-metallic brush.	X	
ANTENNA - The antenna, antenna base and all contacts should be kept clean and free from dirt or corrosion. If the antenna or its base should become coated or poorly grounded, loss or radiation and a weak signal will result.	X	
ALIGNMENT - The transmitter and receiver meter readings should be checked periodically, and the alignment "touched up" when necessary. Refer to the applicable ALIGNMENT PROCEDURE and Troubleshooting Sheet for typical voltage readings.		X
FREQUENCY CHECK - Check transmitter frequency and deviation as required by FCC. Normally, these checks are made when the unit is first put into operation, after the first six months, and once a year thereafter.		X



RC-547A

Figure 2 - Ignition Circuit with Noise Suppression Components

2. Check to see that:

--the distributor points and condenser are in good condition.

--the high-voltage leads from the distributor are not broken and are making good contact at each end.

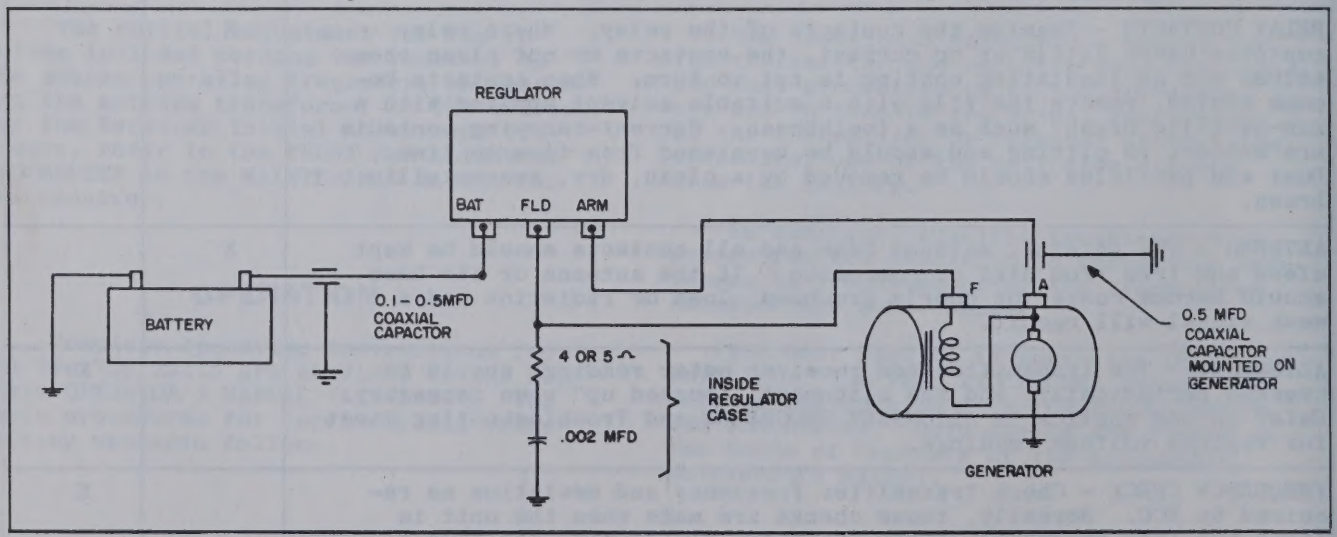
--the spark plugs have clean, dry insulators and their electrodes are clean and properly adjusted.

--the timing has been properly adjusted.

3. Use a 0.5-mFd by-pass capacitor to by-pass the battery lead to the ignition coil. Mount the capacitor under a screw which will provide a good ground and connect the capacitor lead to the terminal of the coil which is connected to the ignition switch.

4. Remove the ignition coil and its mounting bracket. Clean paint from the coil (where the bracket mounts), from the bracket and from the engine block. Remount the coil so as to obtain a good ground for the coil case.

5. If the vehicle has been driven 30,000 or 40,000 miles or more, the cap and rotor of the distributor will probably need replacing. This will not only reduce ignition noise, but also improve the overall performance of the engine.



RC-548A

Figure 3 - Generator Circuit with Noise Suppression Components

6. High-voltage ignition wires can become capacitively coupled to the low-voltage systems, causing ignition noise to appear in the low-voltage system. This coupling can be minimized by separating the high- and low-voltage leads, or if necessary, separately shielding the leads.

7. If one of the ignition leads happens to have the critical length for radiating at the receiver's frequency, the noise can be reduced by changing the length of the lead. A noise source of this type is not common and can be found by using a noise meter or by trial and error.

8. If the preceding steps fail to reduce ignition noise to a satisfactory level, it may be necessary to install resistance-type spark plugs, individual suppressors on each spark plug, or a shielded ignition wire harness.

Generator Noise

Generator noise shown up as a high-pitched "whine", the pitch of which varies with engine speed. To check for this type of noise, run the engine at a moderate speed and then shut off the engine, while listening to the noise turns, lowering in pitch as the engine slows down.

By-pass the armature terminal on the generator to ground with a 0.5-mFd, 40 or 50-amp coaxial capacitor. Be sure to scrape the area where the capacitor is to be mounted, so that its case will be well grounded.

CAUTION

If the regulator is opened to install the capacitor or resistor, remember that one wrong connection or shorted wire can damage the regulator or generator.

Generator Regulator Noise

Generator regulator noise shows up as a "raspy" sound which is generated by the contacts in the regulator and radiated by the leads coming out of the regulator. If suppression of regulator noise is necessary, connect a 5-ohm resistor in series with a .002-mFd capacitor from the field terminal (F) of the regulator to ground. If possible, these components should be mounted inside regulator case. The battery terminal (BAT) and armature terminal (ARM) can be by-passed to ground with 0.5-mFd capacitors.

CAUTION

If the regulator is opened to install the capacitor or resistor, remember that one wrong connection or shorted wire can damage the regulator or generator.

Static and Arcing Noise

The following suggestions may help to cure other unusual types of interference:

1. Use bonding braid to electrically bond the hood and each corner of the engine block to the vehicle's frame. Scrape paint and dirt from bonding paints to obtain a good ground.

2. Treat noisy tires with anti-static powder.

3. Use front-wheel static collectors for irregulator "popping" noise which disappears when the brakes are applied.

4. Use heavily graphited penetrating oil on the exhaust pipe and muffler supports if they are producing noise.

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number of component
2. Description of part
3. Model number of equipment
4. Model number of equipment
5. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company

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MAINTENANCE MANUAL

LBI-3500

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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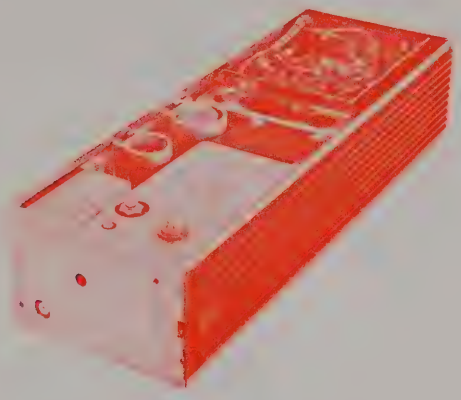
MOBILE RADIO

MASTR PROGRESS LINE

132-174 MHZ, 90-WATT TRANSMITTER MODEL 4ET58F10-21 & 4ET58K10-15

Maintenance Manual LBI-4267D

ET-58-F & K



SPECIFICATIONS *

	ET-58-F (Narrow Band) ET-58-K (Wide Band)
FCC filing Designation:	
Frequency Range:	132—174 MHz
Power Output:	90 watts minimum
Crystal Multiplication Factor:	12
Frequency Stability:	±.0005% (-30°C to +60°C)
Spurious & Harmonic Radiation:	At least 85 dB below rated power output
Modulation:	Adjustable from 0 to ±5 KHz (Narrow Band) and 0 to ±15 KHz (Wide Band) swing with instantaneous modulation limiting
Audio Frequency Characteristics:	Within +1 dB to -3 dB of a 6 dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards. Post limiter filter per FCC and EIA
Distortion:	Less than 5%
Deviation Symmetry: Narrow Band - Wide Band -	 0.5 KHz maximum 1.5 KHz maximum
Tubes & Transistors:	90-watt Transmitter with no Options: 3 tubes 8 transistors 4 diodes
Maximum Frequency Spacing	±0.2%
Duty Cycle: Mobile -	20% transmit (one minute transmit, four minutes off)
Station -	Continuous

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

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Figure 3 Bottom Cover Removed for Servicing 5

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

The MASTR Progress Line FM Transmitter Types ET-58-F and ET-58-K are crystal-controlled, phase-modulated transmitters designed for one-, two-, or four-frequency operation within the 132-174 megahertz band. The transmitter consists of the following modules:

- Transistorized Exciter Board, with audio, oscillator, modulator, amplifier and multiplier stages,
- Tubed multipliers and power amplifier stages,
- Optional transistorized Channel Guard Board (ET-58-F only).

All input leads to the transmitter are individually filtered by the 20-pin feed-through by-pass connector J101. The output passes through a four-section, low-pass filter that features good shielding between sections, and Teflon® capacitors for fail-free operation with an open or shorted antenna.

CIRCUIT ANALYSIS

Eight silicon transistors and only three tubes are used in the transmitter. The frequency of the crystals used ranges from 11 to 14.5 megahertz, and the crystal frequency is multiplied twelve times.

A centralized metering jack (J102) is provided for use with General Electric Test Set 4EX3A10. The Test Set meters the multiplier, amplifier and PA stages as well as filament and regulated supply voltages. The metering jack also provides access to receiver audio, microphone and push-to-talk leads.

POWER INPUTS

The following supply voltages are connected from the power supply to the transmitter through the 20-pin by-pass connector J101:

- Pin 3 — Filament voltage
- Pin 4 — +300 volts MULT B+
- Pin 5 — +650 volts PA B+
- Pin 8 — -45 volts bias
- Pin 14 — +10 volts for Channel Guard option (ET-58-F only)
- Pin 15 — -20 volts for Exciter Board

OSCILLATOR

A transistorized Colpitts oscillator (Q3) is used in the transmitter. The oscillator crystal is thermistor-compensated at both ends of the temperature range to provide instant frequency compensation, with a frequency stability of ±0.0005% without crystal ovens or warmers.

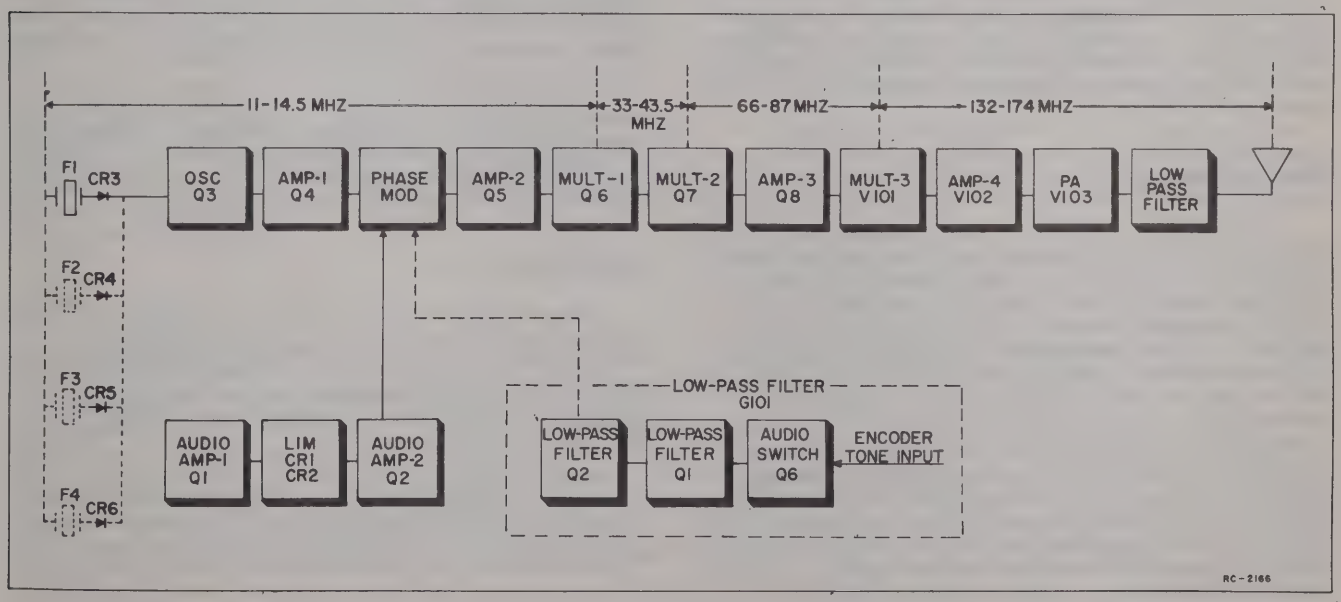


Figure 1 - Transmitter Block Diagram

In single-frequency transmitters, a jumper (from H1 to H2) connects the F1 crystal keying lead to ground to forward bias diode CR3. Forward biasing the diode reduces its impedance, and the crystal frequency is applied to the base of oscillator Q3. Feedback for the oscillator is developed across C34/C35. The oscillator output is coupled through an impedance matching emitter-follower amplifier stage (Q4) to the phase modulator.

In multi-frequency transmitters, the single oscillator transistor is used, and up to three additional crystal circuits, identical to the F1 crystal circuit, can be added. The keying jumper is removed and the proper crystal frequency is selected by switching the crystal keying lead to ground by means of a frequency selector switch on the Control Unit.

AUDIO AMPLIFIERS AND LIMITER

An audio signal from the microphone is coupled through C1 to the base of Class A audio amplifier Q1. The design of the microphone, in conjunction with C2 and R3, produces a 6-dB audio pre-emphasis. RF decoupling is provided by R10 and C75.

The amplified audio signal is RC coupled to the diode limiters, CR1 and CR2. These diodes operate in series and are normally in a forward conducting state. An audio signal of sufficient amplitude to cause limiting takes the diodes out of conduction, so that one diode conducts only on positive cycles and the other conducts only on negative cycles.

Following the limiter stage is a second Class A amplifier, Q2. The output of Q2 is coupled through MOD ADJUST potentiometer R12 to a combined post-limiter filter and de-emphasis network. This network consists of R15, R16, R17, C4, C7 and C8/C9. The output of the filter and de-emphasis network is applied directly to the phase modulator.

PHASE MODULATOR

The phase modulator uses varactor CV1 (voltage variable capacitor) in series with tuneable coil L1/L2. This network appears as a series-resonant circuit to the RF output of the oscillator. An audio signal applied to the modulator varies the bias of CV1, resulting in a phase-modulated output. The output of the modulator is coupled through blocking capacitor C41/C45 to the base of the second amplifier. For Channel Guard and wide band transmitters, a second modulator stage (L3/L4 and CV2) is cascaded with the first modulator. The output of the Channel Guard encoder is fed through CHANNEL GUARD MOD ADJUST R34 to the modulator stages. The voice audio is also applied to both modulator stages.

AMPLIFIERS AND 1ST AND 2ND MULTIPLIERS

The second amplifier (Q5) isolates the modulator from the loading effects of the first multiplier and provides amplification. The output is DC coupled to the first multiplier.

Following Q5 are two inductively coupled Class C, common-emitter multiplier stages (Q6 and Q7). Q6 is a tripler, with collector tank T1 tuned to three times the crystal frequency. Metering resistor R37 is for metering the MULT-1 stage at centralized metering jack J102.

Q7 operates as a doubler stage, with collector tank T3 tuned to six times the crystal frequency. Resistor R39 is for metering the MULT-2 stage at J102. The output of Q7 is inductively coupled through T3 and T4 to amplifier Q8. In 150.8--174 megahertz transmitters, capacitor C58 provides some high-side capacitive coupling.

Third amplifier Q8 is a neutralized straight-through amplifier. Feedback through C65 from the output link on T5 provides neutralization. This stage is metered at J102-3 across R43. The output is coupled to the grid tank of multiplier V101.

3RD MULTIPLIER

The output of the transistorized Exciter is coupled by a short length of RF cable to the grid tank (Z101/Z102) of beam pentode V101. This stage operates as a doubler with the plate tank tuned to twelve times the crystal frequency. The plate tank is tuned by C113.

The grid of V101 is metered through metering resistor R102 at J102-4. R101 drops the bias voltage to approximately -18 volts to protect V101 against loss of drive. Plate voltage is supplied through L101.

When measuring grid current to V101, there will be a residual reading of approximately 0.18 volts without any drive. This is caused by the presence of fixed bias voltage to the grid of the tube.

AMPLIFIER 4

The output of the MULT-3 stage is coupled to the grid of amplifier (V102) by C103, L103/L104 and C113. The grid is metered at J102-5 through metering resistor R108. Bias voltage is supplied through R109 and L103/L104.

When measuring the grid voltage, there will be a residual reading of approximately 0.3 volt without any drive to the stage. The plate tank is series-tuned by C116.

POWER AMPLIFIER

Drive from 4th amplifier V102 is inductively coupled to the grid power amplifier V103 through L106 and L108. R113 adjusts the grid drive to V103 by controlling the screen grid voltage of V101 and V102.

The PA grid is metered at J102-6 across metering resistor R116. Bias voltage is applied to the control grids through R115 and R116.

Power amplifier V103 is a dual tetrode operating in a push-pull circuit. The PA plate is slug-tuned by L111/L112. High B-plus is applied through L118 to a center tap on the plate tank coil, L111/L112. C122 is a mechanical high-voltage by-pass capacitor.

The screen grid dropping resistors are R117 and R118. Plate current is metered from J102-1 to J102-9 across metering resistor R120.

WARNING

The meter leads are at plate potential (high B-plus) when metering the PA Plate.

Placing the TUNE-OPERATE switch (S102) in the OPERATE position applies 300 volts to TB3-5 and TB3-7. The 300 volts appearing on each side of R117 effectively shorts the resistor out of the circuit, and the screen voltage is applied through R118 for normal operation of V102. With S102 in the TUNE position, the screen voltage is applied to TB3-7 only. Now, dropping resistors R117 and R118 are in series, to reduce the screen voltage. This reduces the plate dissipation of V103 while tuning the power amplifier stage.

Antenna coupling is achieved by varying the coupling between L111/L112 and L113/L114. C123 tunes the antenna circuit.

The RF output from the antenna coil is fed to low-pass filter FL101. This filter has a low insertion loss and a harmonic attenuation of at least -50 dB through all harmonics. The filter output is fed to the antenna changeover relay located on the front of the system frame.

CHANNEL GUARD

Low Pass Filter (G101)

In encode-decode combinations, low-pass filter G101 is assembled on a printed wiring board that mounts on the underside of the MASTR transmitters. The filter is supplied by a regulated +10 volts and a regulated -20 volts. The +10 volts is applied continuously (even in the STANDBY position), and the -20 volts is applied only when the transmitter is keyed.

Keying the transmitter applies the encoder tone (from the receiver) to low-pass filter G101. Transistors Q1 and Q2 form a two-section, active low-pass filter that reduces tone distortion and power supply ripple. Q6 operates as a tone switch, applying the tone input to the filter whenever +10 volts is applied to J1 (Q6 base). Thermistor RT1 keeps the output constant over wide variations in temperature. The filter output is coupled to the tone modulator on the transmitter exciter board through Channel Guard MOD ADJUST R34. Instructions for setting R34 are contained in the Modulation Adjustment section of the Transmitter Alignment Procedure.

The channel can be monitored before transmitting a message by moving the CG-OFF switch on the Control Unit to the OFF position, or by removing the microphone or handset from the operational hang-up bracket.

NOTE

When Channel Guard decode only is desired, remove the wire that connects to J6 on the low-pass filter (Encoder Tone Input).

Encoder Model 4EH17A10 (Optional)

In encode only combinations, encoder Model 4EH17A10 mounts on the underside of the MASTR transmitter. The encoder is supplied by a regulated +10 volts and a regulated -20 volts. The +10 volts is applied to Q3, Q4 and Q5 continuously (even in the STANDBY position). The -20 volts is applied to Q1 and Q2 only when the transmitter is keyed.

The encoder tone is provided by selective oscillators Q3 and Q4, which oscillate continuously at a frequency determined by the tone network (FL1). Negative feedback, applied through the tone network to the base of Q3, prevents any gain in the stage except at the desired encode frequency.

Thermistor-resistor combination R14 and RT2 provides temperature compensation for the oscillator output. Limiter diodes CR1 and CR2 keep the tone amplitude constant.

Keying the transmitter applies -20 volts to the two-stage, active low-pass filter (Q1 and Q2) turning them on. The oscillator output is then coupled through emitter-follower Q5 to the low-pass filter. Thermistor RT1 keeps the filter output constant over wide variations in temperatures.

The output of the filter is applied to the tone modulator on the transmitter exciter board through Channel Guard MOD ADJUST R34. Instructions for setting R34 are contained in the Modulation Adjustment section of the Transmitter Alignment Procedure.

The channel can be monitored before transmitting a message by moving the CG-OFF switch on the Control Unit to the OFF position, or by removing the microphone or handset from the operational hang-up bracket.

REDUCED POWER OPERATION

STATION APPLICATIONS

Station power supply Model 4EP38A10-12 may be modified to operate at reduced power. Select one of the modifications ("A" thru "D") shown in the chart that meets the desired power limitations.

Refer to the applicable Power Supply Maintenance Manual for the required modifications.

	PA POWER OUTPUT LIMIT	TYPICAL PA PLATE VOLTAGE	MAX. PA PLATE POWER INPUT	MAX. EFFI-CIENCY
A*	65 Watts	467 VDC	109 Watts	60%
B	40-58 Watts	415-435 VDC	101 Watts	60%
C	35-40 Watts	297-300 VDC	70 Watts	60%
D	30-38 Watts	275-280 VDC	65 Watts	60%

* Modification "A" is required for operation under Part 93 (Land Transportation Radio Services) of FCC rules. If Option 7044 is ordered, the power supply will be modified before shipment from the factory.

MOBILE APPLICATIONS

The mobile transmitter with power supply Model 4EP37A10 power supply may be operated at reduced power (120-Watt plate input limitation) as required by Part 93 (Land Transportation Radio Services) and Part 21 (Domestic Public Radio Services) of FCC rules by using the following procedure.

Power Supply Modification*

Move the jumper in the secondary of transformer T501 from T501-23 to T501-22. This modification provides a typical plate voltage of 550 Volts.

Transmitter Alignment Procedure

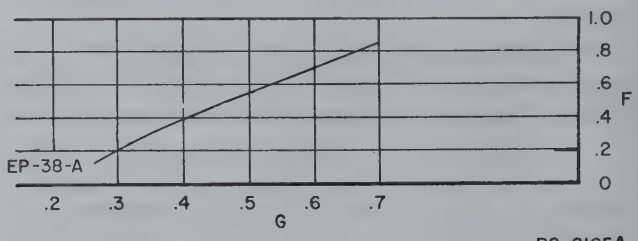
Tune the transmitter according to the Standard Alignment Procedure. Instead of loading the power amplifier to 0.7 Volts, the maximum loading voltage will be given by the following formula:

$$V\ load = \frac{381.6}{Vp}$$

•Vp = measured voltage on the PA plate when loaded.

V load = metered voltage with the GE Test Set Model 4EX3A10 set at position "G". Under no conditions should the reading exceed 0.7 Volts.

Whenever station operation at reduced power results in a test meter reading of less than 0.7 Volts, R113 should be adjusted to reduce the meter reading with the Test Set at position "F" according to the following curve.



RC-2165A

MAINTENANCE

DISASSEMBLY

To service the transmitter from the top --

1. Pull locking handle down and pull radio about one inch out of mounting frame.
2. Pry up cover at rear of transmitter.
3. Slide cover back and lift off.

To service the transmitter from the bottom --

1. Pull locking handle down and pull radio out of mounting frame.
2. Remove the two screws in the bottom cover, and pry up at back of transmitter.
3. Slide cover back and lift off.

Figure 2 - Top Cover Removed

Figure 3 - Bottom Cover Removed

NOTE

The tube shields for the 90-watt transmitter are spring-loaded, and can be pulled off of the tube.

To remove transmitter from system frame --

1. Loosen the two retaining screws in the front casting (see Figure 2) and pull casting away from the system frame.
2. Remove the four screws in the back cover.
3. Remove the two screws holding the transmitter at each end of the system frame.
4. Disconnect the antenna jack in front of the transmitter and the 20-pin feed-thru connector at the back of the transmitter, and slide the unit out of the system frame.

ON METER J102	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
(+) d (-)	PA PLATE (L112/L111)	Minimum	Tune (L112/L111) (PA PLATE) for minimum meter reading.
	ANT TUNING and ANT COUPLING	0.70 v	Alternately Tune ANT TUNING for maximum meter reading, and adjust ANT COUPLING counterclockwise for a meter reading of 0.70 volts, maximum.
			Repeat Steps 7 and 13.
FREQUENCY ADJUSTMENT			
			With no modulation, adjust crystal trimmer C10 (or C16, C22, C28 as required) for proper oscillator frequency. Next, refer to the MODULATION ADJUSTMENT. ——— NOTE ——— For proper frequency control of the transmitter, it is recommended that all frequency adjustments be made when the equipment is at a temperature of approx. 75° F. In no case should frequency adjustments be made when the equipment is outside the temperature range of 50° to 90°F.

FOR TWO-FREQUENCY OPERATION

			For channel spacings less than 0.2% of operating frequency, follow Steps 1-13 (single frequency transmitter) using the highest frequency.
5	MULT-3 PLATE C113	Equal Readings on both Channels	For channel spacings greater than 0.2%, and up to a maximum of 0.4% of operating frequency, follow steps 1-13 (single frequency transmitter) using the highest frequency, then set test meter to "E" and tune C113 for equal reading on both channels.
4(+) d 6(-)	AMP-4 PLATE C116	Equal Reading on both Channels	Set test meter selector switch to "F". Tune C116 for equal reading on both channels. Adjust R113 for highest reading consistent with max. power output. Typical reading 0.4 volts minimum to 0.85 volts maximum.
1(+) d 9(-)		0.7 V	Rotate ANT COUPLING for minimum meter reading. Adjust PA PLATE for equal reading on each channel. Adjust ANT COUPLING for a reading of 0.70 volts maximum on the highest reading channel. Readings between channels should not differ by more than .02 volts.

FOR THREE or FOUR FREQUENCY OPERATION

			Follow Steps 1-13 (single frequency transmitter) using the channel nearest the center frequency.
4(+) d 6(-)	AMP-4 PLATE C116	0.9 V on highest Reading Channel	Tune C116 for equal readings on highest and lowest frequency. Set R113 for highest reading consistent with maximum power output, using the frequency showing the highest reading.
(+) d (-)		0.7 V	Adjust ANT COUPLING for a maximum reading of 0.7 volts on the highest reading channel.

(DF-3125)

ALIGNMENT PROCEDURE

132—174 MHZ, 90-WATT MASTR TRANSMITTER
MODELS 4ET58F10-21 & 4ET58K10-15

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R12) was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause overmodulation are clipped by the modulation limiter. The limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing overmodulation while preserving intelligibility.

TEST EQUIPMENT

1. An audio oscillator Model 4EX6A10
2. A frequency modulation monitor
3. An output meter or a VTVM
4. GE Test Set Models 4EX3A10 or 4EX8K10, 11

PROCEDURE

1. Connect the audio oscillator and the meter across audio input terminals J5 (Green-Hi) and J6 (Black-Lo) on GE Test Set or across J1 (Mike High) and J2 (Mike Low) on the Exciter Board.
2. Apply a 1.0-volt signal at 1000 Hz to Test Set or across J1 and J2 on Exciter Board.
3. For transmitters without Channel Guard, set the MOD ADJUST (R12) for a 4.5-kilohertz swing (13.5 KHz for wide band) with the deviation polarity which gives the highest reading as indicated on the frequency modulation monitor.
4. For transmitters with Channel Guard, set the Channel Guard MOD ADJUST (R34) for 0.75 KHz tone deviation. Then repeak L1/L2 and L3/L4 as shown in Step 1 of Transmitter Alignment Procedure. Reset tone deviation to 0.75 KHz deviation. Remove the tone to the transmitter by unplugging leads to J7 and J8 on Exciter Board, or by switching to a non-Channel Guard frequency in multifrequency units. Next, apply a 1.0 volt signal at 1000 Hz and set MOD ADJUST (R12) for 3.75 KHz deviation (4.5 KHz minus 0.75-KHz tone deviation).
5. For multi-frequency transmitters, set the deviation as described in Steps 3 or 4 on the channel producing the largest amount of deviation.

PA PLATE POWER INPUT

For FCC purposes, the PA Plate power input can be determined by measuring the PA Plate voltage and the plate current indication, and using the following formula:

$$\text{ET-58-F \& K:}\quad P_i = \frac{\text{Plate Voltage} \times \text{Plate Current Indication}}{3.0}$$

Where:

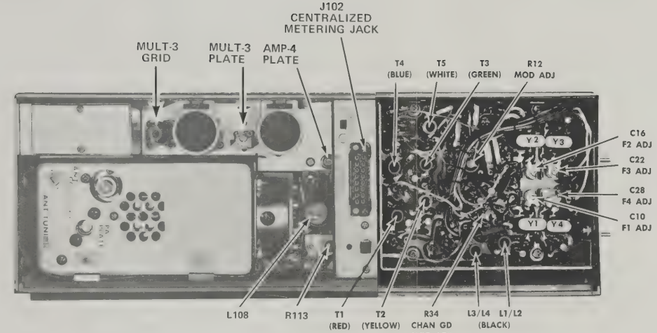
P_i is the power input in watts.

Plate voltage is measured with GE Test Set in position G, using the 1000-volt scale (or measured from J102-1 to -16 with multimeter).

Plate current indication is measured with GE Test Set in Position G, using the TEST 1 scale (or measured from J102-1 to -9 with multimeter).

3.0 is the value of the plate current metering resistor in ohms.

(IF-4125)



TRANSMITTER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A10, 4EX8K10 or 11, Station Metering Panel, or a 20,000 ohms-per-volt Multimeter with a 1-volt scale.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal (operating frequency ± 12) in crystal socket XY1.
2. For a large change in frequency or a badly misaligned transmitter, set crystal trimmer C10 to mid-capacity. If multi-frequency transmitter, set all trimmers to mid-capacity and tune transmitter on channel with the highest frequency (except for Step 12).
3. Place the TUNE-OPERATE switch (S102) in the TUNE position.
4. Connect Test Set Model 4EX3A10 to the Transmitter Centralized Metering Jack J102. If using Multimeter, connect the positive lead to J102-16 (Ground) except if otherwise indicated in Multimeter, Metering Position block.
5. For a large change in frequency or a badly misaligned transmitter, set the slugs in the Exciter coils at the bottom of the coil form, and the slug of MULT-3 GRID (Z101/Z102) at the top of the coil form.
6. All adjustments are made with the transmitter keyed.

STEP	METERING POSITION GE TEST SET	METERING POSITION MULTIMETER - at J102	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
			EXCITER BOARD		
1.	A (MULT-1)	Pin 10	L1/L2 (and L3/L4 with Channel Guard)	0.8 v (0.5 v Minimum)	Tuning the modulator is a critical adjustment. Carefully tune L1/L2 for maximum meter reading. For channel guard or wideband transmitters, alternately tune L1/L2 and L3/L4 for maximum meter reading.
2.	A (MULT-1)	Pin 10	T1	See Procedure	Tune T1 for a small peak in meter reading (not required unless changing frequency).
3	B (MULT-2)	Pin 2	T2, T1 and T3	0.65 v (0.5 v Minimum)	Tune T2 and then T1 for maximum meter reading. Then tune T3 for minimum meter reading (not required unless changing frequency).
4.	C (AMPL-3)	Pin 3	T4, T3 and T5	0.6 v (0.5 v Minimum)	Tune T4 and then T3 for a maximum meter reading. Then tune T5 for minimum meter reading (not required unless changing frequency).
			MULT-3 AND POWER AMPLIFIER		
5.	D (MULT-3)	Pin 4	MULT-3 GRID	0.6 v (0.45 v Minimum)	Tune MULT-3 GRID and then T5 for maximum meter reading.
6.	E (AMPL-4)	Pin 5	MULT-3 PLATE (R113, C116)	0.55 v (0.45 v Minimum	Tune MULT-3 PLATE for maximum meter reading. Tune C116 for minimum meter reading. Set R113 to center of range.
7.	F (PA GRID)	Pin 14(+) and Pin 6(-)	AMPL-4 PLATE (C116) PA GRID (L108)	0.65 v	Alternately tune AMPL-4 PLATE and PA GRID (C116-L108) for maximum meter reading. Adjust R113 for highest reading consistent with max. power output. Typical readings 0.4 v minimum to 0.85 volts maximum. ——— NOTE ——— The tuning slug in L108 should not be adjusted below the top of the coil and should not touch L106.
8.					Rotate ANT COUPLING fully clockwise.
9.	G (PA PLATE)	WARNING High B-Plus on Pins 1 & 9		Minimum	Carefully tune PA PLATE for minimum meter reading. ——— NOTE ——— Do not turn adjusting screw too far because the slug assembly may drop out of holder.
		Pin 1(+) and Pin 9(-)	PA PLATE (L112, C111)		
10.					Place S102 (TUNE-OPERATE) switch in OPERATE position.
11.	G (PA PLATE)	Pin 1(+) and Pin 9(-)	ANT COUPLING	Minimum	Adjust ANT COUPLING for minimum meter reading.

FOR SINGLE-FREQUENCY TRANSMITTERS

STEP	METERING POSITION GE TEST SET	METERING POSITION MULTIMETER - at J102	TUNING CONTROL	TYPICAL METER READING	PROCEDURE
12.	G (PA PLATE)	Pin 1 (+) and Pin 9 (-)	PA PLATE (L112-L111)	Minimum	Tune (L112/L111) (PA PLATE) for minimum meter reading.
13.	"	"	ANT TUNING and ANT COUPLING	0.70 v	Alternately Tune ANT TUNING for maximum meter reading, and adjust ANT COUPLING counterclockwise for a meter reading of 0.70 volts, maximum.
14.	"	"			Repeat Steps 7 and 13.
			FREQUENCY ADJUSTMENT		
15.					With no modulation, adjust crystal trimmer C10 (or C16, C22, C28 as required) for proper oscillator frequency. Next, refer to the MODULATION ADJUSTMENT. ——— NOTE ——— For proper frequency control of the transmitter, it is recommended that all frequency adjustments be made when the equipment is at a temperature of approx. 75° F. In no case should frequency adjustments be made when the equipment is outside the temperature range of 50° to 90 F.

FOR TWO-FREQUENCY OPERATION

12.					For channel spacings less than 0.2% of operating frequency, follow Steps 1-12 (single frequency transmitter) using the highest frequency.
13.	E (AMPL-4)	Pin 5	MULT-3 PLATE C113	Equal Readings on both Channels	For channel spacings greater than 0.2%, and up to a maximum of 0.4% of operating frequency, follow steps 1-13 (single frequency transmitter) using the highest frequency, then set test meter to "E" and tune C113 for equal reading on both channels.
14.	F (PA GRID)	Pin 14(+) and Pin 6(-)	AMP-4 PLATE C116	Equal Reading on both Channels	Set test meter selector switch to "F". Tune C116 for equal reading on both channels. Adjust R113 for highest reading consistent with max. power output. Typical reading 0.4 volts minimum to 0.85 volts maximum.
15.	G (PA PLATE)	Pin 1(+) and Pin		0.7 V	Rotate ANT COUPLING for minimum meter reading. Adjust PA PLATE for equal reading on each channel. Adjust ANT COUPLING for a reading of 0.70 volts maximum on the highest reading channel. Readings between channels should not differ by more than .02 volts.

FOR THREE or FOUR FREQUENCY OPERATION

12.					Follow Steps 1-13 (single frequency transmitter) using the channel nearest the center frequency
13	F (PA GRID)	Pin 1(+) at Pin 6(-)	AMP-4 PLATE C116	0.9 V on highest Reading Channel	Tune C116 for equal readings on highest and lowest frequency. Set R113 for highest reading consistent with maximum power output, using the frequency showing the highest reading.
14.	G (PA PLATE)	Pin 1 (+) and Pin 9 (-)		0.7 V	Adjust ANT COUPLING for a maximum reading of 0.7 volts on the highest reading channel

ALIGNMENT PROCEDURE

132—174 MHZ, 90-WATT MASTR TRANSMITTER
MODELS 4ET58F10-21 & 4ET58K10-15

uard, the Phase Modulator Tuning should be peaked carefully
Refer to Steps 1 and 2 in the Transmitter Alignment Chart).

es should be repeated everytime the Tone Frequency is changed.

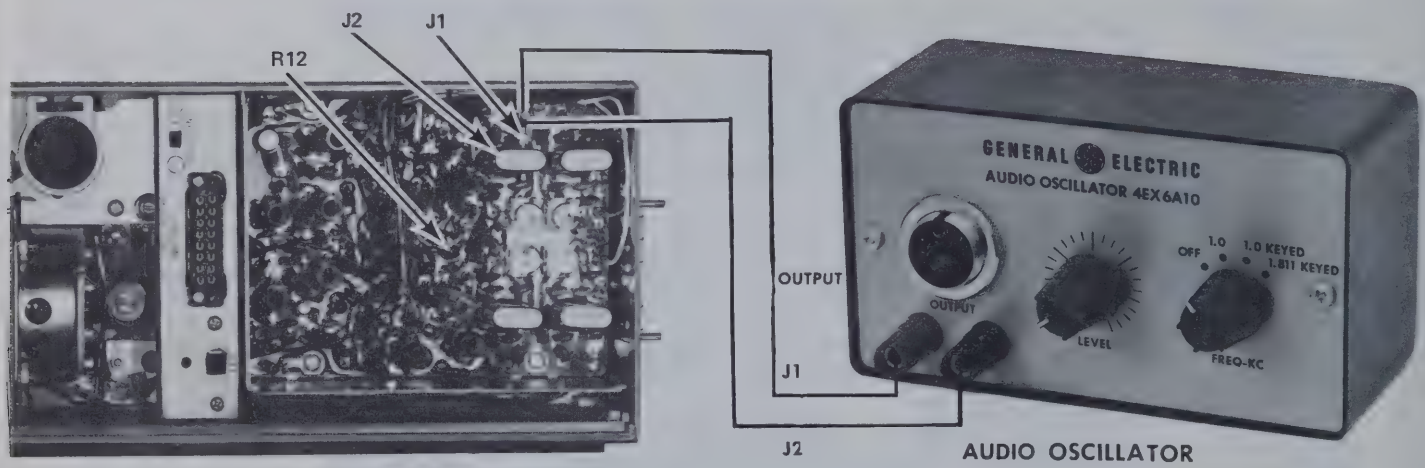
tainable when adjusting R34, replace the Tone Transmitter reed.

STEP 3

ETRY

ads from the Exciter Board Jacks J1 and J2.

nitter as shown below:

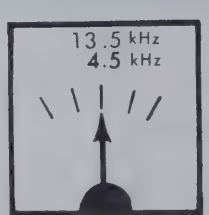


AUDIO OSCILLATOR

) VOLTS RMS and frequency to 1 KHz.

Deviation Meter to carrier frequency
.5 KHz. (±13.5 KHz wide band).

rol" R12 until deviation reads
plus (+) or minus (-) deviation,
justment should be made with
ied on Channel Guard transmitters.



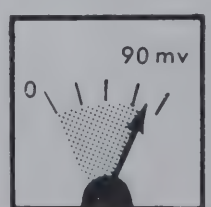
DEVIATION METER

sted for 4.5 KHz (13.5 KHz wide band)
e factory adjustment will prevent the
re than 5.0 KHz (15 KHz wide band) under
ency, voltage and temperature.

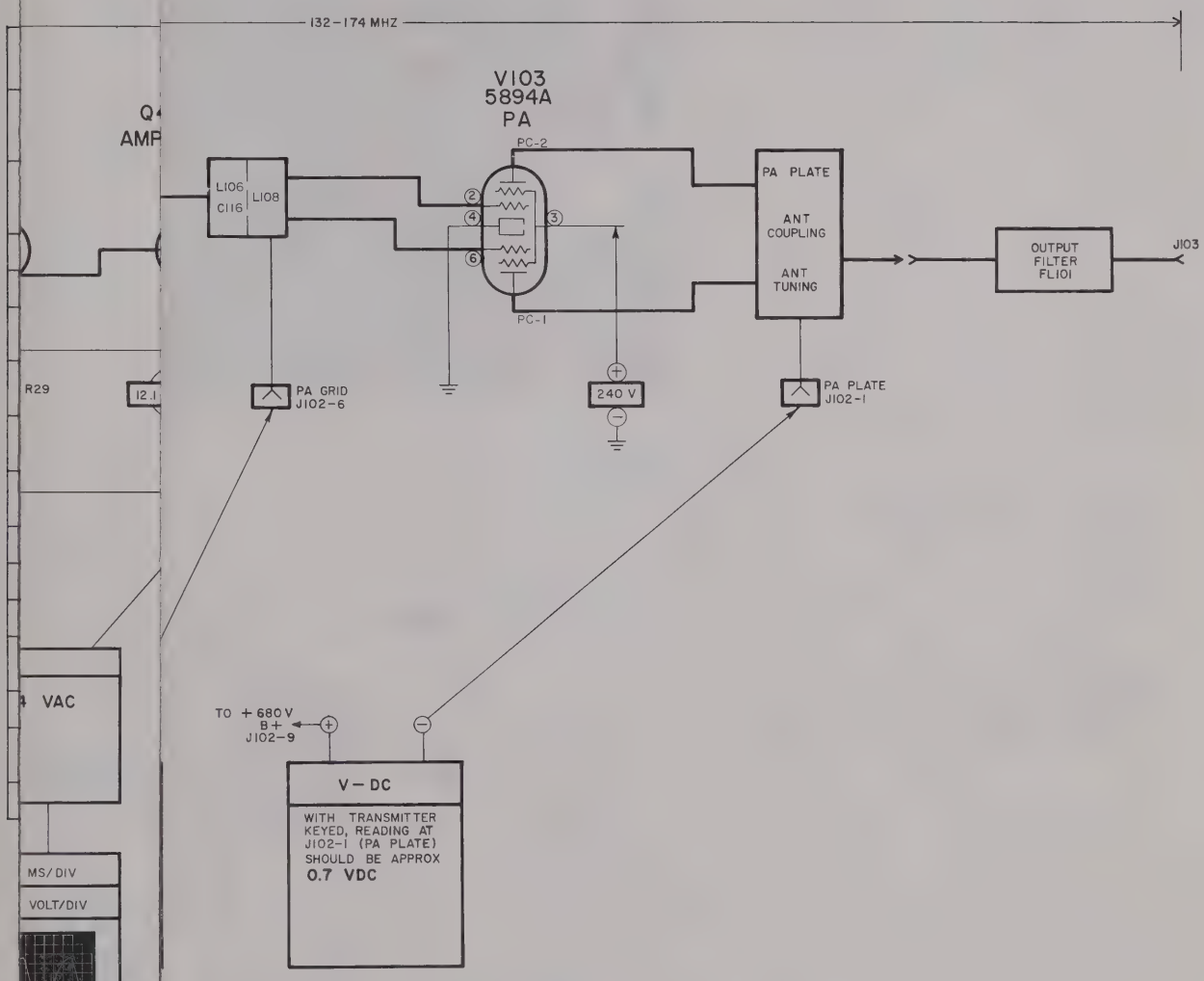
and minus (-) differs by more than 0.5 KHz, (1.5 KHz wide band)

Transmitter Alignment Chart.

lucing generator output until deviation
band). Voltage should be Less than 90



METER



TROUBLESHOOTING PROCEDURE

132—174 MHZ, 90-WATT MASTR TRANSMITTER
MODELS 4ET58F10-21 & 4ET58K10-15

TEST PROCEDURES

These Test Procedures are designed to assist you in servicing a transmitter that is operating--but not properly. Problems encountered could be low power output, low B plus, tone and voice deviation, defective audio sensitivity and modulation adjust control set too high. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once a defect is pin-pointed, refer to the "Service Check" and the additional corrective measures included in the Transmitter Troubleshooting Procedure. Before starting with the Transmitter Test Procedures, be sure the transmitter is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

for test hookup as shown:

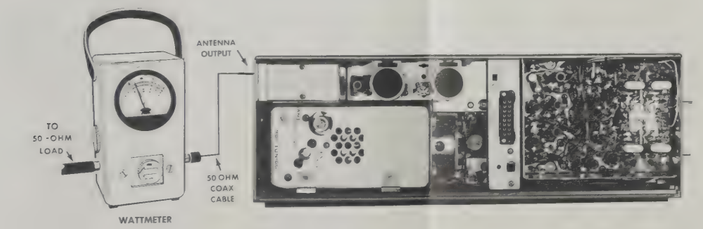
1. Wattmeter similar to:
   - Bird #43
   - Jones #711N
2. VTVM similar to:
   - Triplett #850
   - Heath #1M-21
3. Audio Generator similar to:
   - GE Model 4EX6A10 or
   - Heath #1G-72
4. Deviation Meter (with a .75 KHz scale) similar to:
   - Measurements #140
   - Lampkin #205A
5. Multipmeter similar to:
   - GE METERING TEST SET MODEL 4EX3A10 or
   - Triplett #631 or
   - 20,000 ohms-per-volt voltmeter

STEP 1

POWER MEASUREMENT

TEST PROCEDURE

1. Connect transmitter output to wattmeter as shown below:



2. Key transmitter and check wattmeter for minimum reading of 80 watts.

SERVICE CHECK

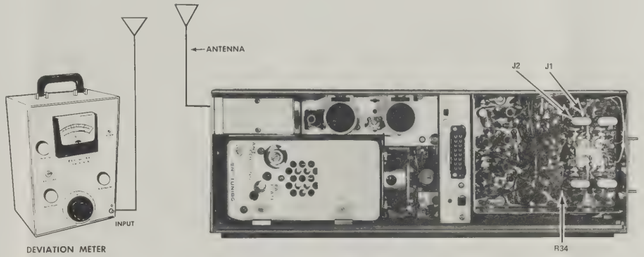
Refer to Service Hints on Transmitter Troubleshooting Procedure.

STEP 2

TONE DEVIATION WITH CHANNEL GUARD

TEST PROCEDURE

1. Setup Deviation Meter and monitor output of transmitter as shown below:



2. Unplug the MIC HI terminal from J1 on Transmitter Exciter Board.

3. Key transmitter and check for 0.75 KHz deviation. If reading is low or high, adjust Channel Guard MOD ADJUST (R34) for a reading of 0.75 KHz.

NOTES:

The Channel Guard MOD ADJUST (R34) may be adjusted for deviations up to 0.80 KHz for tone frequencies from 71.9 Hz to 82.5 Hz and deviations up to 1.0 KHz for all tone frequencies above 82.5 Hz.

DEVIATION METER

NOTES:

1. On units supplied with Channel Guard, the Phase Modulator Tuning should be peaked carefully to insure proper performance. (Refer to Steps 1 and 2 in the Transmitter Alignment Chart).

2. The tone Deviation Test Procedures should be repeated everytime the Tone Frequency is changed.

SERVICE CHECK

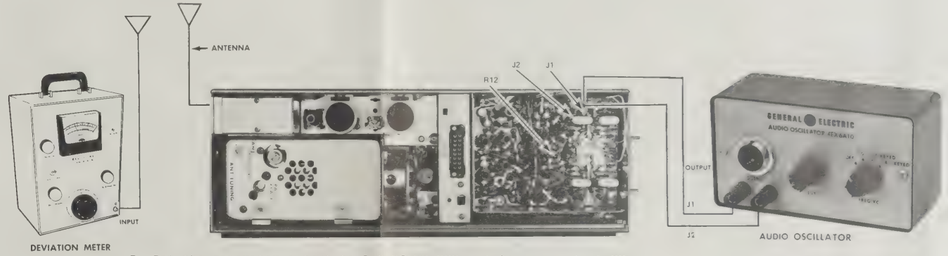
If the 0.75 KHz deviation is not obtainable when adjusting R34, replace the Tone Transmitter reed.

STEP 3

VOICE DEVIATION AND SYMMETRY

TEST PROCEDURE

1. Unplug the High and Low Mike leads from the Exciter Board Jacks J1 and J2.
2. Connect test equipment to transmitter as shown below:



3. Set the generator output to 1.0 VOLTS RMS and frequency to 1 KHz.
4. Key the transmitter and adjust Deviation Meter to carrier frequency
5. Deviation reading should be ±4.5 KHz. (±13.5 KHz wide band).
6. Adjust "Modulation Adjust Control" R12 until deviation reads 4.5 KHz (13.5 KHz wide band) on plus (+) or minus (-) deviation, whichever is greater. This adjustment should be made with the correct level of tone applied on Channel Guard transmitters.

DEVIATION METER

NOTES: --MASTR transmitters are adjusted for 4.5 KHz (13.5 KHz wide band) deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 KHz (15 KHz wide band) under the worst conditions of frequency, voltage and temperature.

If the deviation reading plus (+) and minus (-) differs by more than 0.5 KHz. (1.5 KHz wide band) check the following:

1. **Recheck Step 1 as shown in the Transmitter Alignment Chart.**

2. **Check Audio Sensitivity by reducing generator output until deviation falls to 3.0 kHz (10 kHz wide band). Voltage should be Less than 90 millivolts.**

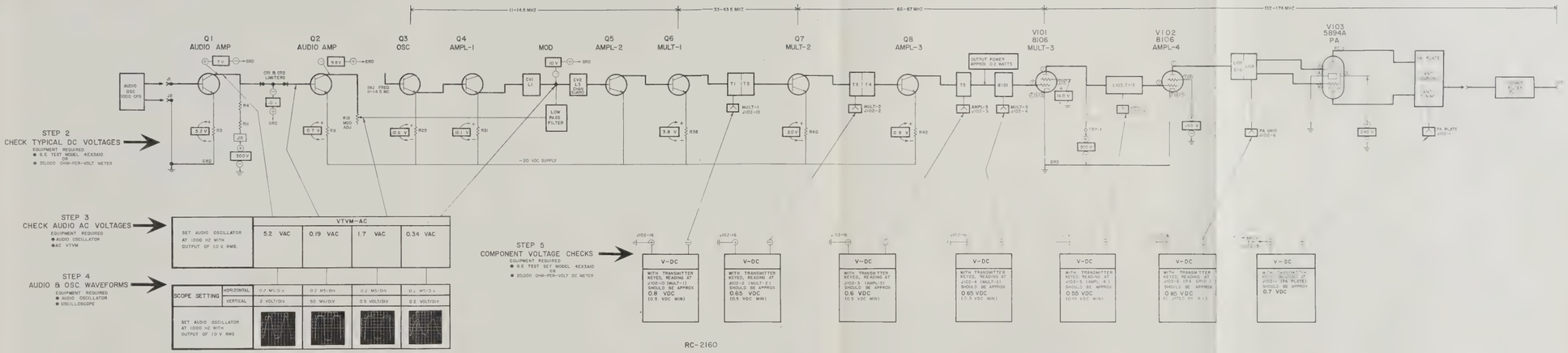
METER

STEP 1 — QUICK CHECKS

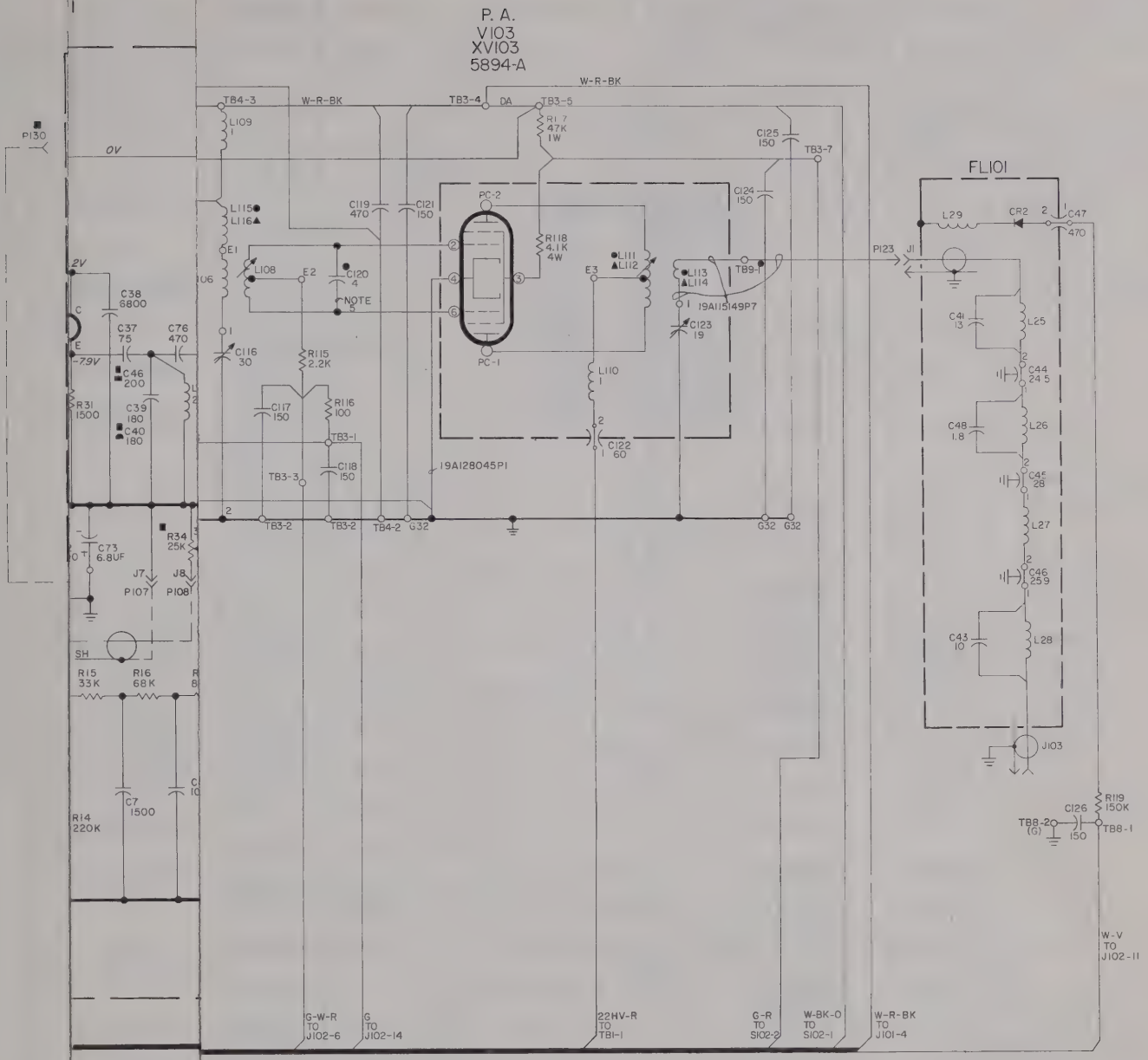
POWER OUTPUT	CHECK VOLTAGES AT CENTRALIZED METERING JACK J102 Multimeter = pin numbers GE Test Set = A-G positions							PROBABLE DEFECT
	Pins 10 & 16 A	Pins 2 & 16 B	Pins 3 & 16 C	Pins 4 & 16 D	Pins 3 & 16 E	Pins 6 & 14 F	Pins 1 & 9 G	
Low	0.8 v	0.65 v	0.6 v	0.6 v	0.55 v	Low	0.7 v	Weak 5894A or Loose Hardware in output tank circuit, or bad filter.
0	0.8 v	0.65 v	0.6 v	0.6 v	0.55 v	.37 v	0	Open 5894A
0	0.8 v	0.65 v	Low	.18 v	.37 v	.37 v	0	Open Filament on 8106
0	0.8 v	0.65 v	0 or over 1.0 v	.18 v	.37 v	.37 v	0	Defective Q8
0	0.8 v	0 or over 1.0 v	0	.18 v	.77 v	.37 v	0	Defective Q7
0	Over 1.2 v	0	0	.18 v	.37 v	.37 v	0	Shorted Q6 or Open Q5
0	0	0	0	.18 v	.37 v	.37 v	0	Defective Q3-Q6 or Modulator (see Note A)

NOTE A --- Localize trouble by checking:--

1.	-20 volt DC supply at J102-12-16.
2.	Measure 12.1 VDC across Q4 emitter resistor R31 (1500 ohms), then:
(a)	Remove crystal - a slight variation in R31 voltage reading indicates Q3 and Q4 stages operating properly.
(b)	If no voltage is measured, check keying leads CR3-CR6, Q3, Q4.
(c)	With crystal removed, short Q5 base to emitter. A voltage reading above 1.0 volt indicates Q5 and Q6 are operating properly. Defect may be in Modulator.
(d)	If modulator is defective, check voltage variable diodes CV1 and CV2.


11-14.5 MHz
33-43.5 MHz
66-87 MHz
132-174 MHz
Q1 AUDIO AMP
Q2 AUDIO AMP
Q3 OSC
Q4 AMPL-1
MOD
Q5 AMPL-2
Q6 MULT-1
Q7 MULT-2
Q8 AMPL-3
V101 8106 MULT-3
V102 8106 AMPL-4
V103 5894A PA
AUDIO OSC 1000 CPS
CR5 & CR6 LIMITERS
INJ. FREQ 11-14.5 MC
LOW PASS FILTER
OUTPUT POWER APPROX 0.5 WATTS
-20 VDC SUPPLY
STEP 2
CHECK TYPICAL DC VOLTAGES
EQUIPMENT REQUIRED
● G.E. TEST MODEL 4EX3A10
OR
● 20,000 OHM-PER-VOLT METER
STEP 3
CHECK AUDIO AC VOLTAGES
EQUIPMENT REQUIRED
● AUDIO OSCILLATOR
● AC VTVM
VTVM-AC
SET AUDIO OSCILLATOR AT 1000 HZ WITH OUTPUT OF 10 K RMS.
5.2 VAC
0.19 VAC
1.7 VAC
0.34 VAC
STEP 4
AUDIO & OSC. WAVEFORMS
EQUIPMENT REQUIRED
● AUDIO OSCILLATOR
● OSCILLOSCOPE
SCOPE SETTING
HORIZONTAL
VERTICAL
SET AUDIO OSCILLATOR AT 1000 HZ WITH OUTPUT OF 10 V RMS
STEP 5
COMPONENT VOLTAGE CHECKS
EQUIPMENT REQUIRED
● G.E. TEST SET MODEL 4EX3A10
OR
● 20,000 OHM-PER-VOLT DC METER
V-DC
WITH TRANSMITTER KEYED, READING AT J102-10 (MULT-1) SHOULD BE APPROX 0.8 VDC (0.5 VDC MIN)
WITH TRANSMITTER KEYED, READING AT J102-2 (MULT-2) SHOULD BE APPROX 0.65 VDC (0.5 VDC MIN)
WITH TRANSMITTER KEYED, READING AT J102-3 (AMPL-3) SHOULD BE APPROX 0.6 VDC (0.5 VDC MIN)
WITH TRANSMITTER KEYED, READING AT J102-4 (MULT-3) SHOULD BE APPROX 0.65 VDC (0.5 VDC MIN)
WITH TRANSMITTER KEYED, READING AT J102-5 (AMPL-4) SHOULD BE APPROX 0.55 VDC (0.45 VDC MIN)
WITH TRANSMITTER KEYED, READING AT J102-6 (PA GRID) SHOULD BE APPROX 0.85 VDC
WITH TRANSMITTER KEYED, READING AT J102-7 (PA PLATE) SHOULD BE APPROX 0.7 VDC

RC-2160



SPECIFIED.

MOVE W-R

ADS OF
OSSIBLE.
P3

MEASURED
VOLTMETER,

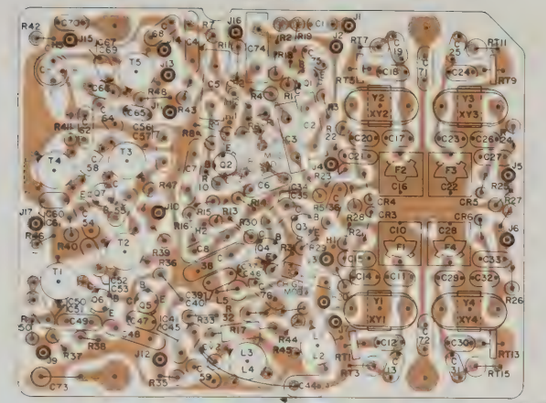
WERE
SING A 470K
AND Q2 ON
GROUND
MEASURE
Q2

(DF-3125)

SCHEMATIC DIAGRAM

132—174 MHZ, 90-WATT MASTR TRANSMITTER
MODELS 4ET58F10-21 & 4ET58K10-15

EXCITER A101 - A112



(19C303483, Sh. 1, Rev. 7)
(19C303483, Sh. 2, Rev. 7)

EXCITER READINGS TAKEN TO CHASSIS GROUND

TRANSISTOR	EMITTER		BASE		COLLECTOR	
	−	+	−	+	−	+
Q1	6.5K	6.8K	240K	12K	50K	20K
Q2	6.2K	4K	70K	2K	9.8K	10K
Q3	9K	2.7K	9K	2.7K	100	10K
Q4	1	5K	9K	2.7K	100	K
Q5	5K	2.7K	70K	10.8K	3.7K	2.3K
Q6	4K	3.2K	3.7K	2.3K	175	75
Q7	5.2K	2.3K	5K	2.7K	465	465
Q8	5K	2.7K	5K	2.7K	67	67

EXCITER READINGS TAKEN TO 20 VOLT LINE (J-5 BLUE LEAD)

TRANSISTOR	EMITTER		BASE		COLLECTOR	
					−	+

BEFORE CHANNEL GUARD MODIFICATION

RESISTANCE READINGS

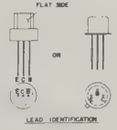
ALL READINGS ARE TYPICAL READINGS MEASURED WITH A 20,000 OHM PER VOLT METER AND J101 DISCONNECTED + OR − SIGNS SHOW METER LEAD GROUNDED

FOR READINGS OF	USE SCALE
1-100Ω	R x 1
100-1KΩ	R x 10
[illegible]	[illegible]
50 <> Ω	R x 100,000

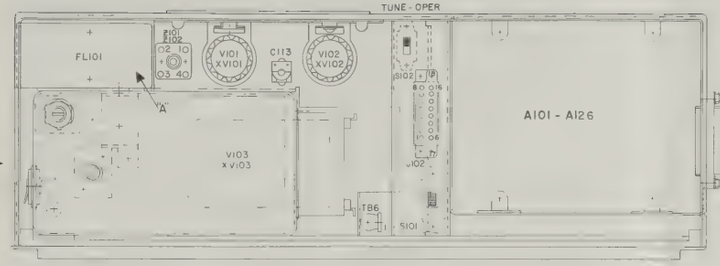
RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

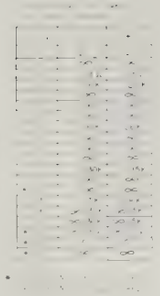
LOW-PASS FILTER G101

(19C311800, Sh. 1, Rev. 2)
(19C311800, Sh. 2, Rev. 2)

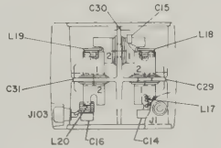


TOP VIEW



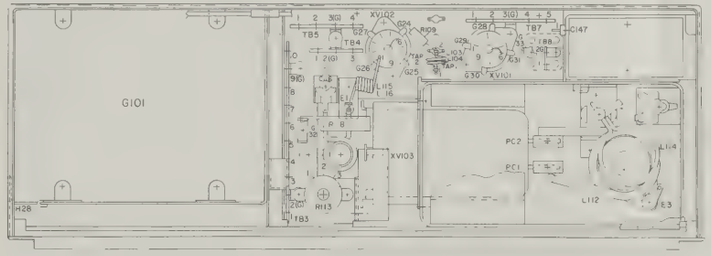


VIEW AT "A"



VIEW AT "B"

BOTTOM VIEW



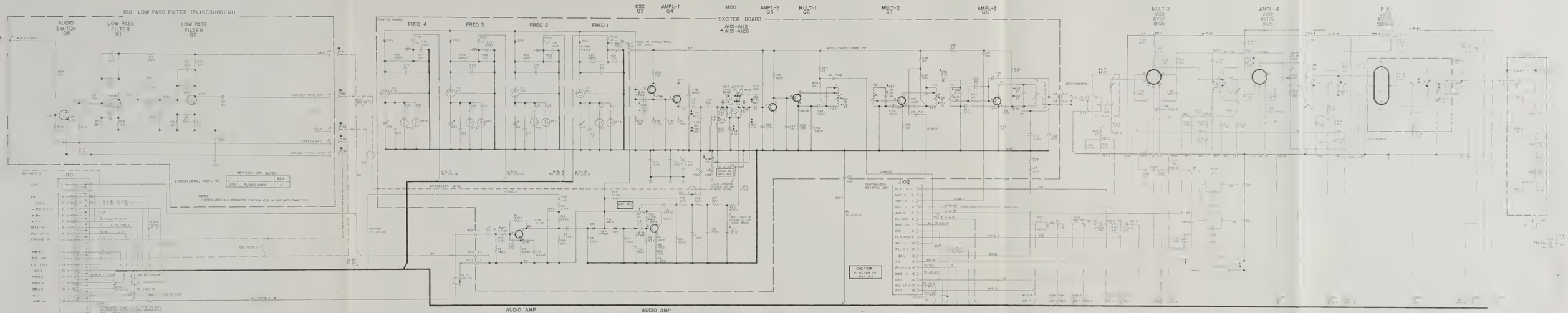
READINGS TAKEN FROM TUBE SOCKET PINS TO CHASSIS GROUND

PIN	1	2	3	4	5	6	7	8	9	10	11	12
XV101	550K	0	583K	0	14Ω	0	30K	583K	0			
XV102	0	0	550K	550K	550K	0	83K	0	0	60K	83K	14Ω
XV103	14Ω	50K	550K	0	0.9Ω	50K	Gₙ					

(19R621723, Rev. 0)

OUTLINE DIAGRAM

132—174 MHZ, 90-WATT MASTR TRANSMITTER
MODELS 4ET58F10-21 & 4ET58K10-15



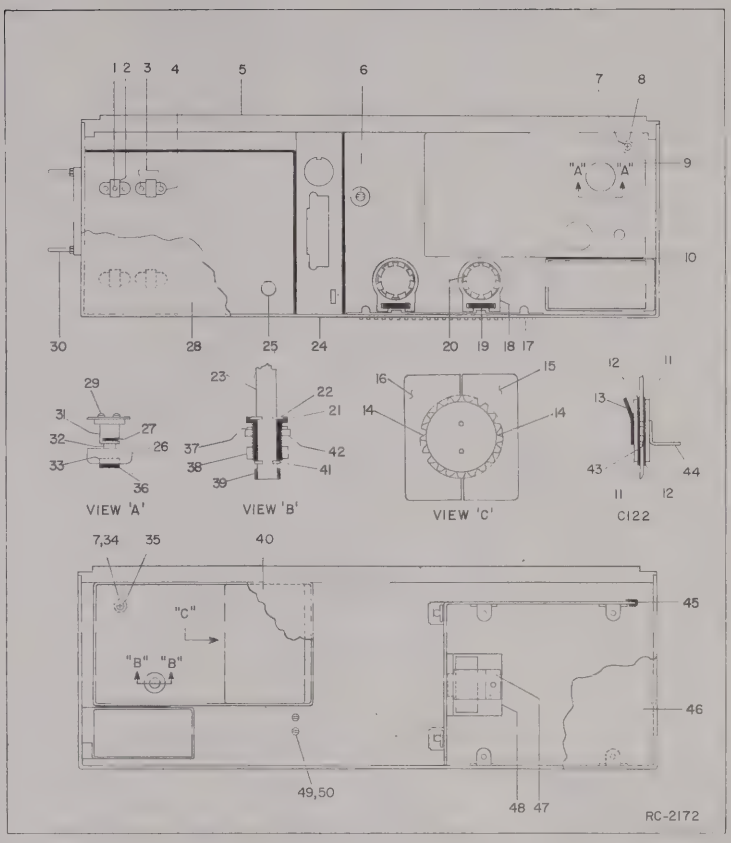
SCHEMATIC DIAGRAM

132—174 MHZ. 90-WATT MASTR TRANSMITTER
MODELS 4ET58F10-21 & 4ET58K10-15

NO.	DESCRIPTION
	- - - - - - - - - - TERMINALS - - - - - - - - - -
G1	Terminal.
	Terminal, solder: sim to Zierick Mfg Corp 505.
	- - - - - - - - JACKS AND RECEPTACLES - - - - - - -
G1	Connector: 20 pin contacts.
G1	Connector: 18 contacts.
	(Part of FL101).
	- - - - - - - - - - INDUCTORS - - - - - - - - - -
	Choke, RF: 2.2 µh ±10%, 1 ohm DC res; sim to Jeffers 4411-12K.
G2	Coil.
G1	Coil.
P1	Coil.
G1	Coil.
	Choke, RF: 1.00 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4411-8.
G1	Coil.
G1	Coil.
G1	Coil.
G1	Coil.
P2	Coil.
P1	Coil.
P1	Coil.
P2	Coil.
	- - - - - - - - - - PLUGS - - - - - - - - - -
	Contact, electrical; sim to Amp 42827-2.
	Contact, electrical; sim to Amp 41854.
	Contact, electrical; sim to Amp 42827-2.
	Contact, electrical; sim to Amp 42827-2.
	Contact, electrical; sim to Amp 41854.
	Contact, electrical; sim to Amp 42827-2.
21	Contact, electrical: sim to Bead Chain R125-22.
	- - - - - - - - - RESISTORS - - - - - - - - -
	Composition: 270 ohms ±10%, 1/2 w.
	Composition: 15,000 ohms ±10%, 1/2 w.
	Composition: 47,000 ohms ±10%, 1/2 w.
P444	Metal film: 0.28 megohm ±2%, 1/2 w.
	Composition: 18,000 ohms ±10%, 1/2 w.
	Composition: 270 ohms ±10%, 1/2 w.
	Composition: 27,000 ohms ±10%, 1/2 w.
	Composition: 15,000 ohms ±10%, 1/2 w.
	Composition: 1000 ohms ±10%, 1/2 w.
	Composition: 4700 ohms ±10%, 1/2 w.
P 2332K	Metal film: 2200 ohms ±10%, 2 w; sim to Mallory Type 2 MOL.
P7	Variable, wirewound: 10,000 ohms ±20%, 3 w; sim to CTS Series 117.
	Composition: 12,000 ohms ±10%, 2 w.

SYMBOL	G-E PART NO	DESCRIPTION
R115		(Part of L108).
R116	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R117	3R78P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R118	19A116479P4412K	Metal film: 4100 ohms ±10%, 4 w; sim to Mallory Type 4 MOL.
R119	3R77P154K	Composition: 0.15 megohm ±10%, 1/2 w.
R120	19A115416P7	Wirewound: 3 ohms ±1%, 2 w; sim to Dale Type RS-2B.
R121	3R77P123K	Composition: 12,000 ohms ±10%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S101	4031922P1	Push: single pole, single throw, normally open, 1/2 amp at 12 VDC; sim to Stackpole Type SS-15.
S102	19B209040P1	Slide: DPDT, 0.5 amp at 125 v; sim to Continental Wirt Type 126.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7487424P2	Miniature, phen: 1 terminal.
TB3	7775500P26	Phen: 10 terminals.
TB4	7775500P107	Phen: 3 terminals.
TB5	7775500P10	Phen: 4 terminals.
TB6	7775500P44	Phen: 2 terminals.
TB7	7775500P111	Phen: 5 terminals.
TB8	7487424P1	Miniature, phen: 1 terminal.
		- - - - - - - - - - TUBES - - - - - - - - - -
V101 and V102		Type 8106.
V103		Type 5894A.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XV101 and XV102	7480532P8	Tube, phen: 9 pins; sim to Elco 04-903-84.
XV103	7489471P3	Tube, ceramic or steatite: 7 pins.
		- - - - - - - - - - COILS - - - - - - - - - -
Z101	19B219309G1	Coil. Includes:
C1	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
Z102	19B219309G2	Coil. Includes:
C1	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		MECHANICAL PARTS (SEE RC-2172)
1	19B200525P9	Rivet. (Part of XY1-XY4).
2	4033089P1	Clip. (Part of XY1-XY4).
3	19A115793P1	Contact, electrical: sim to Malco 2700. (Part of XY1-XY4).
4	19C311172P2	Crystal socket. (Part of XY1-XY4).
5	19C303395G4	Chassis heat sink.
6	19C317518G1	Tuning slug. (Part of L108).
7	N80P13004C13	Screw, phillips head: No. 6-32 x 1/4.
8	4035306P35	Fiber washer.
9	19C317517G1	Tuning chassis.
10	19A121527P1	Plate.
11	19A121006P8	Washer, aluminum. (Part of C122).
12	19A121018P2	Washer, teflon. (Part of C122).
13	7878455P1	Terminal, solderless. (Part of C122).
14	7165167P3	Tube shield insert. (Part of V103- a quantity of 2 is required).

SYMBOL	G-E PART NO	DESCRIPTION
15	19B204793P2	Heat sink. (Lower) (Used with V103).
16	19B204792P1	Heat sink. (Upper) (Used with V103).
17	19C303599P1	Heat sink.
18	19A121523P1	Heat sink. (Used with V101 and V102).
19	19B205622P1	Spring. (Used with V101 and V102).
20	7165167P5	Tube shield insert: sim to Atlas 106-332-5. (Used with V101 and V102).
21	4031530P1	Bearing. (Part of Post assembly).
22	4031532P1	Cup washer. (Part of Post assembly).
23	19A127917P1	Post. (Part of Post assembly).
24	19B204395G3	Chassis.
25	4036555P1	Insulator disc: nylon. (Used with Q8 on A101-A112, A121-A126).
26	19A127896P2	Can. (Part of PA Plate Assembly).
27	19A127922P1	Spring. (Part of PA Plate Assembly).
28	19C303495G8	Station top cover. (Except Repeaters and VM).
	19C303673G3	Station top cover. (Repeaters and VM only).
	19C303396G1	Mobile top cover.
29	N81P15004C	Screw, phillips head: 8-32 x 1/4.
30	19A121676P1	Guide pin. (Used with J101).
31	19A128027G1	Bushing. (Part of PA Plate Assembly).
32	19A127900P1	Shaft. (Part of PA Plate Assembly).
33	19A127899P1	Disc. (Part of PA Plate Assembly).
34	4036899P33	Insulator stop.
35	N81P13004C6	Screw, phillips head: 6-32 x 1/4.
36	N81P9006C	Screw, phillips head: 4-40 x 3/8.
37	7115130P9	Lockwasher: sim to Shakeproof 1220-2. (Part of Post Assembly).
38	4031531P1	Locknut: No. 32. (Part of Post Assembly).
39	4031527P2	Collar. (Part of Post Assembly).
40	19C303605P1	Tuning cover.
41	N910P18C13	Retaining ring. (Part of Post Assembly).
42	7893938P1	Nut: No. 38. (Part of Post Assembly).
43	4031594P2	Insulator, teflon.
44	7878455P2	Terminal, solderless.
45	4029030P10	Channel, rubber.
46	19C303495G7	Station Bottom Cover.
	19C303396G3	Mobile Bottom Cover.
47	19A121065P1	Support. (Used with FL1, XFL1).
48	19A121257G1	Angle. (Used with FL1, XFL1).
49	N75P1006C13	Screw, machine: brass 0-80 x 3/8.
50	N207P1C13	Nut, brass: 0-80 thread.



PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for description of parts affected by these revisions.

REV. A thru E - (Exciter Board A101-106, A121-A126)

REV. A thru F - (Exciter Board A107-A112)
Incorporated into initial shipment

REV. A & B - (Channel Guard Low Pass Filter G101)
Incorporated into initial shipment

REV. A - (Channel Guard Encoder G102)
Incorporated into initial shipment

PARTS LIST

LBI-4264A

152-174 MHz TRANSMITTER
MODELS: 4ET58F10 - 4ET58F21
MODELS 4ET58E10 - 4ET58E15

SYMBOL	GE PART NO.	DESCRIPTION
		EXCITER BOARD ASSEMBLY
A10, 10A1, A112	A10	19D403298G1 - 4ET58D10
	A102	19D403298G2 - 4ET58F11
	A103	19D403298G3 - 4ET58F13
A121 thru A129	A104	19D403298G4 - 4ET58F13
	A105	19D403298G5 - 4ET58F14
	A106	19D403298G6 - 4ET58F15
	A107	19D403298G7 - 4ET58F16
	A108	19D403298G8 - 4ET58F17
	A109	19D403298G9 - 4ET58F18
	A110	19D403298G10 - 4ET58F19
	A111	19D403298G11 - 4ET58F20
	A112	19D403298G12 - 4ET58F21
	A121	19D403298G13 - 4ET58E10
	A122	19D403298G14 - 4ET58A11
	A123	19D403298G15 - 4ET58A12
	A124	19D403298G16 - 4ET58A13
	A125	19D403298G17 - 4ET58A14
	A126	19D403298G18 - 4ET58A15
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P9	Polyester: .022 mf ±20%, 50 VDCW.
C2	19A116080P4	Polyester: .033 mf ±20%, 50 VDCW.
C3	19A116080P7	Polyester: 0.1 mf ±20%, 50 VDCW.
C4	7491395P114	Ceramic disc: 2300 mf ±10%, 500 VDCW; sim to RMC Type JL.
C5	19A116080P7	Polyester: 0.1 mf ±20%, 50 VDCW.
C6	19A116080P5	Polyester: .047 mf ±20%, 50 VDCW.
C7	7491395P111	Ceramic disc: 1500 pf ±10%, 500 VDCW.
C8	5483367P1000X	Silver mica: 1000 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-20.
C10	5493717P106	Variable, subminiature: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C11	5496219P7	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C12 and C13	19C300685P03	Ceramic disc: 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C14	5496219P751	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C15	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C16	5493717P106	Variable, subminiature: approx 2.1-12.7 pf, 750 v peak; sim to EF Johnson 189.
C17	5496219P7	Ceramic disc: 7 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C19 and C19	19C300685P03	Ceramic disc: 5 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
C20	5496219P751	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C50	5496219P241	Ceramic disc: 10 pf ±5%, 500 VDCW, temp coef -80 PPM.
C51	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C52	5496219P244	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
C53	5496219P33	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C54	5496219P751	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef -750 PPM.
C55	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C56	5496219P33	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C57	5496219P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C58	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C59	5493366P230X	Silver mica: 230 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-10.
C60	5496219P241	Ceramic disc: 10 pf ±5%, 500 VDCW, temp coef -80 PPM.
C61	5496219P244	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
C62	19A116656P33X	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C63	5496219P7	Ceramic disc: 7 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C64	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C65	5496219P33	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C66	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C67	5496219P247	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -80 PPM.
C68	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.

SYMBOL	G-E PART NO.	DESCRIPTION
C69	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C70 thru C72	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C73	5496367P18	Tantalum: 6.8 pf ±20%, 35 VDCW; sim to Sprague Type 150D.
C74	19A115414P13	Polyester: 0.1 pf ±20%, 200 VDCW.
C75	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RM Type JF Discap.
C76	5493366P470X	Mica: 470 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-10.
C77	5493366P270X	Mica: 270 pf ±10%, 100 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 and CR2	19A115350P1	Silicon.
CR3 thru CR5	19A115603P1	Silicon.
CY1 and CY2	5485769P8	Silicon, capacitive.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J17	6035513P4	Contact, electrical: sim to Bead Chain L63-3.
		- - - - - - - - INDUCTORS - - - - - - - - -
L1	19B204526G18	Coil. Includes tuning slug 5491798P2.
L2	19B204526G11	Coil. Includes tuning slug 5491798P3.
L3	19B204526G6	Coil. Includes tuning slug 5491798P2.
RI	2A152P233J	Composition: 33,000 ohms ±5%, 1/4 w.
L4	19B204526G3	Coil. Includes tuning slug 5491798P2.
RI	2A152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
L5	7488079P48	Choke, RF: 27 µh ±10%, 1.4 ohms DC res; sim to Jeffers 4422-5K.
		- - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q3	19A115132P1	Silicon, NPN; sim to Type 2N3713.
Q2 thru Q8	19A115330P1	Silicon, NPN.
Q6 and Q7	19A115332P1	Silicon, NPN.
Q9	19A115362P1	Silicon, NPN; sim to Type 2N2925.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3A779534K	Composition: 0.33 megohm ±10%, 1/2 w.
R2	3A779105K	Composition: 1 megohm ±10%, 1/2 w.
R3	3A779473K	Composition: 4700 ohms ±10%, 1/2 w.
R4	3A779226K	Composition: 0.22 megohm ±10%, 1/2 w.
R5	3A779334K	Composition: 0.33 megohm ±10%, 1/2 w.
R6	3A779684K	Composition: 0.68 megohm ±10%, 1/2 w.
R7	3A779334K	Composition: 0.33 megohm ±10%, 1/2 w.
R8	3A779823K	Composition: 82,000 ohms ±10%, 1/2 w.
R9	3A779103K	Composition: 1000 ohms ±10%, 1/2 w.
R10 and R11	3A779274K	Composition: 0.27 megohm ±10%, 1/2 w.
R12	19B209354P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.

SYMBOL	GE PART NO.	DESCRIPTION
R13 and R14	3A779224K	Composition: 0.22 megohm ±10%, 1/2 w.
R15	3A779333K	Composition: 33,000 ohms ±10%, 1/2 w.
R16	3A779683K	Composition: 68,000 ohms ±10%, 1/2 w.
R17	3A779823K	Composition: 82,000 ohms ±10%, 1/2 w.
R18	3A779683K	Composition: 68,000 ohms ±10%, 1/2 w.
R19	3A779222K	Composition: 2200 ohms ±10%, 1/2 w.
R20	3A779683K	Composition: 6800 ohms ±10%, 1/2 w.
R21	3A779153K	Composition: 15,000 ohms ±10%, 1/2 w.
R22	3A779683K	Composition: 6800 ohms ±10%, 1/2 w.
R23	3A779153K	Composition: 15,000 ohms ±10%, 1/2 w.
R24	3A779683K	Composition: 6800 ohms ±10%, 1/2 w.
R25	3A779153K	Composition: 15,000 ohms ±10%, 1/2 w.
R26	3A779683K	Composition: 6800 ohms ±10%, 1/2 w.
R27 and R28	3A779153K	Composition: 15,000 ohms ±10%, 1/2 w.
R29	3A779273K	Composition: 27000 ohms ±10%, 1/2 w.
R30	3A779103K	Composition: 100 ohms ±10%, 1/2 w.
R31	3A779152K	Composition: 1500 ohms ±10%, 1/2 w.
R32 and R33	3A779103K	Composition: 10,000 ohms ±10%, 1/2 w.
R34	19B209353P107	Variable, carbon film: approx 75 to 25,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R35	3A779683K	Composition: 68,000 ohms ±10%, 1/2 w.
R36	3A779393K	Composition: 3900 ohms ±10%, 1/2 w.
R37	3A779750J	Composition: 75 ohms ±5%, 1/2 w.
R38	3A779391K	Composition: 390 ohms ±10%, 1/2 w.
R39	3A779629J	Composition: 62 ohms ±5%, 1/2 w.
R40	3A779181K	Composition: 180 ohms ±10%, 1/2 w.
R41	3A779470K	Composition: 47 ohms ±10%, 1/2 w.
R43	3A779270K	Composition: 27 ohms ±10%, 1/2 w.
R43	3A779300J	Composition: 30 ohms ±5%, 1/2 w.
R44	3A779223K	Composition: 22,000 ohms ±10%, 1/2 w.
R45	3A779153K	Composition: 15,000 ohms ±10%, 1/2 w.
R46	18A116378P474	Metal film: 470,000 ohms ±2%, 1/2 w.
R47	3A779381K	Composition: 380 ohms ±10%, 1/2 w.
R48	3A779470K	Composition: 47 ohms ±10%, 1/2 w.
R50	3A779103K	Composition: 100 ohms ±10%, 1/2 w.
R51	3A779511J	Composition: 510 ohms ±5%, 1/2 w.
R52	3A779564J	Composition: 0.36 megohm ±5%, 1/2 w.
R53	3A152P472K	Composition: 4700 ohms ±10%, 1/4 w.
		- - - - - - - - THERMISTORS - - - - - - - - -
RT1	19B209284P6	Disc: 75 ohms res nominal at 25°C, color code blue.
RT3	19B209284P5	Rod: 21,400 ohms res nominal at 25°C, color code red.
RT5	19B209284P6	Disc: 75 ohms res nominal at 25°C, color code blue.
RT7	19B209284P5	Rod: 21,400 ohms res nominal at 25°C, color code red.
RT9	19B209284P6	Disc: 75 ohms res nominal at 25°C, color code blue.
RT11	19B209284P5	Rod: 21,400 ohms res nominal at 25°C, color code red.
RT13	19B209284P6	Disc: 75 ohms res nominal at 25°C, color code blue.
RT15	19B209284P5	Rod: 21,400 ohms res nominal at 25°C, color code red.

SYMBOL	G-E PART NO	DESCRIPTION
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T1	19B204534G1	Coil. Includes tuning slug 5491798P4.
T2	19B204531G1	Coil. Includes tuning slug 5491798P4.
T3	19B204535G1	Coil. Includes tuning slug 5491798P4.
T4	19B204533G2	Coil. Includes tuning slug 5491798P4.
T5	19B204537G1	Coil. Includes tuning slug 5491798P4.
		- - - - - - - - - SOCKETS - - - - - - - - - -
XY1 thru XY4		Refer to Mechanical Parts (RC-2172).
		- - - - - - - - - CRYSTALS - - - - - - - - -
		NOTE: When reordering give GE Part No. and specify exact freq needed.
		Crystal Freq - Operating Freq
Y1 thru Y4	19B206175P6	Quartz: freq range 11.000 to 13.566 KHz; temp range -30°C to +85°C. (132-150.8 MHz Transmitter).
Y1 thru Y6	19B206175P7	Quartz: freq range 12.566 to 14.500 KHz, temp range -30°C to +85°C. (150.8-174 MHz Transmitter).
G101		- - - - - - - - - OSCILLATORS - - - - - - - - -
		LOW PASS FILTER ASSEMBLY 19C311809G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P103	Polyester: 0.022 mf ±10%, 50 VDCW.
C2	19A116080P3	Polyester: 0.022 pf ±20%, 50 VDCW.
C3	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	19A116080P9	Polyester: 0.33 pf ±20%, 50 VDCW.
C5	19A116080P8	Polyester: 0.15 pf ±20%, 50 VDCW.
C6	19A116080P3	Polyester: .022 pf ±20%, 50 VDCW.
C7	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C8	19B209343P14	Polyester: 0.33 pf ±20%, 250 VDCW.
C13	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
J1 thru J6	6033513P4	Contact, electrical: sim to Bead Chain L63-3.
		- - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A115132P1	Silicon, NPN; sim to Type 2N3713.
Q3	19A115133P1	Silicon, NPN; sim to Type 2N3713.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3A779733K	Composition: 73,000 ohms ±10%, 1/2 w.
R2	3A779183K	Composition: 18,000 ohms ±10%, 1/2 w.
R3	3A779274K	Composition: 0.27 megohm ±10%, 1/2 w.
R4	3A779250J	Composition: 92 ohms ±5%, 1/2 w.
R5	3A779822K	Composition: 8200 ohms ±10%, 1/2 w.
R6	3A779153K	Composition: 15,000 ohms ±10%, 1/2 w.
R7	3A779103K	Composition: 1000 ohms ±10%, 1/2 w.
R8	3A779183K	Composition: 18,000 ohms ±10%, 1/2 w.
R9	3A779184K	Composition: 0.18 megohm ±10%, 1/2 w.
R10	3A779632J	Composition: 6300 ohms ±5%, 1/2 w.
R11	3A779330K	Composition: 33 ohms ±10%, 1/2 w.
R24	3A779103K	Composition: 10,000 ohms ±10%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R25	3A779473K	Composition: 47,000 ohms ±10%, 1/2 w.
R26	3A779103K	Composition: 10,000 ohms ±10%, 1/2 w.
R27	3A779513K	Composition: 5100 ohms ±10%, 1/2 w.
		- - - - - - - - THERMISTORS - - - - - - - - -
RT1	5490828P30	Rod: 0.33 megohm ±10% res, 1 w max; sim to Globar Type 763H-3.
J100	19B205689G1	Connector: 18 contacts.
J103		CHANNEL GUARD INSTALLATION KIT 19A115174G2
		- - - - - - - - MISCELLANEOUS - - - - - - - - -
P130 thru P135	4029840P2	Contact, electrical: sim to Amp 42827-3.
		CHASSIS AND PA ASSEMBLY 19B500926G1, G2
		- - - - - - - - - CAPACITORS - - - - - - - - -
C101 and C102	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C103		(Part of L103, L104).
C104 and C105	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW, sim to RMC Type JF Discap.
C106 and C107	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C108	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C109	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C111 and C112	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C113	19A116480P5	Variable: approx than 2.8 to 22 pf, 500 VDCW; sim to EF Johnson 189.
C114 and C115	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
P100 thru P113	4029840P2	Contact, electrical: sim to Amp 42827-3.
C116	19B209329P10	Variable: approx 2.62 to 30.6 pf; sim to EF Johnson Type V 183-10-2.
C117 and C118	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
P115 thru P117	4029840P2	Contact, electrical: sim to Amp 42827-3.
C119	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
P123	6033513P1	Contact, electrical: sim to Bead Chain R125-22.
C130	5496318P235	Ceramic disc: 4.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C131	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C122		(Part of Mechanical Parts).
C123	7491394P6	Variable, stri: approx 4.0-10 pf; sim to Tolerado T-8974-M.
R101	3A779233K	Composition: 270 ohms ±10%, 1/2 w.
R102	3A779153K	Composition: 15,000 ohms ±10%, 1/2 w.
R103	3A779473K	Composition: 47,000 ohms ±10%, 1/2 w.
R104	18A116278P4464	Metal film: 0.38 megohm ±2%, 1/2 w.
R105	3A779183K	Composition: 18,000 ohms ±10%, 1/2 w.
R106	3A779273K	Composition: 270 ohms ±10%, 1/2 w.
R107	3A779273K	Composition: 27,000 ohms ±10%, 1/2 w.
R108	3A779153K	Composition: 15,000 ohms ±10%, 1/2 w.
R109	3A779102K	Composition: 1000 ohms ±10%, 1/2 w.
R111	3A779472K	Composition: 4700 ohms ±10%, 1/2 w.
R112	19A116479P2	Metal film: 2200 ohms ±10%, 2 w; sim to Mallory Type 2 MX.
R100	19B209311	Variable, wirewound: 10,000 ohms ±20%, 3 w; sim to CTS Series 117.
R114	3A779123K	Composition: 12,000 ohms ±10% 2 w
		- - - - - - - - FILTERS - - - - - - - - -
FL101		LOW PASS FILTER ASSEMBLY 19D402233G10
		The low pass filter is factory tuned. If it is found to be defective it is recommended that the entire filter assembly be replaced to maintain rated power output and spurious attenuation.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - TERMINALS - - - - - - - - -
E1	19A127909G1	Terminal.
E3	4036594P1	Terminal, solder: sim to Zierick Mfg Corp 505.
		- - - - - - - - - JACKS AND RECEPTACLES - - - - - - - - -
J100	19C303429P	Connector: 20 pin contacts.
J102	19B205689G1	Connector: 18 contacts.
		CHANNEL GUARD INSTALLATION KIT 19A115174G2
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
L101	7488079P8	Choke, RF: 2.2 µh ±10%, 1 ohm DC res; sim to Jeffers 4411-15K.
L103	19A128037G2	Coil.
L104	19A128037G1	Coil.
L106	19B209065P1	Coil.
L108	19B219361G1	Coil.
L109 and L110	7488079P6	Choke, RF: 1.00 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4431-8.
L111	19B209007G1	Coil.
L112	19B209009G1	Coil.
L113	19B301957G1	Coil.
L114	19B219035G1	Coil.
L115	19A128035P2	Coil.
L116	19A128035P1	Coil.
L117 and L118	19A128034P1	Coil.
L119 and L120	19A128034P2	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P101	4029840P2	Contact, electrical: sim to Amp 42827-2.
P102	4029840P3	Contact, electrical: sim to Amp 41854.
P103 thru P106	4029840P2	Contact, electrical: sim to Amp 42827-2.
P100 thru P113	4029840P2	Contact, electrical: sim to Amp 42827-3.
P114	4029840P1	Contact, electrical: sim to Amp 41854.
P115 thru P117	4029840P2	Contact, electrical: sim to Amp 42827-2.
P123	6033513P1	Contact, electrical: sim to Bead Chain R125-22.
		- - - - - - - - - RESISTORS - - - - - - - - -
R101	3A779233K	Composition: 270 ohms ±10%, 1/2 w.
R102	3A779153K	Composition: 15,000 ohms ±10%, 1/2 w.
R103	3A779473K	Composition: 47,000 ohms ±10%, 1/2 w.
R104	18A116278P4464	Metal film: 0.38 megohm ±2%, 1/2 w.
R105	3A779183K	Composition: 18,000 ohms ±10%, 1/2 w.
R106	3A779273K	Composition: 270 ohms ±10%, 1/2 w.
R107	3A779273K	Composition: 27,000 ohms ±10%, 1/2 w.
R108	3A779153K	Composition: 15,000 ohms ±10%, 1/2 w.
R109	3A779102K	Composition: 1000 ohms ±10%, 1/2 w.
R111	3A779472K	Composition: 4700 ohms ±10%, 1/2 w.
R112	19A116479P2	Metal film: 2200 ohms ±10%, 2 w; sim to Mallory Type 2 MX.
R100	19B209311	Variable, wirewound: 10,000 ohms ±20%, 3 w; sim to CTS Series 117.
R114	3A779123K	Composition: 12,000 ohms ±10% 2 w

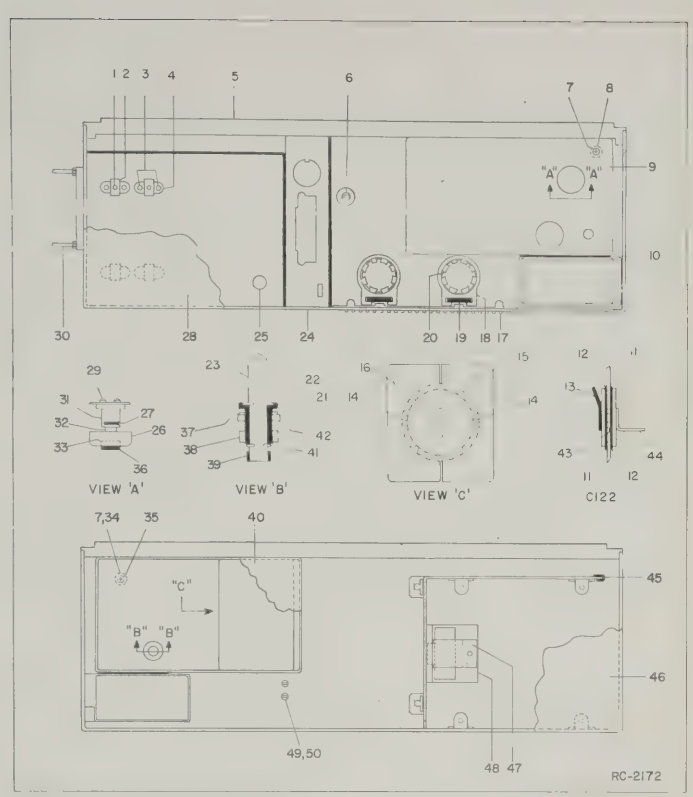
SYMBOL	G-E PART NO	DESCRIPTION
		(Part of L108).
R115 thru R117	3A779101J	Composition: 100 ohms ±5%, 1/2 w.
R118	3A779473K	Composition: 47,000 ohms ±10%, 1/2 w
R119	19A116478P4472	Metal film: 4100 ohms ±10%, 4 w; sim to Mallory Type 4 MX.
R120	3A779154K	Composition: 0.15 megohm ±10%, 1/2 w.
R121	19A115416P7	Wirewound: 3 ohms ±1%, 2 w; sim to Dale Type RS-20.
R122	3A779123K	Composition: 12,000 ohms ±10%, 1/2 w.
		- - - - - - - - - SWITCHES - - - - - - - - -
S101	6031932P1	Push: single pole, single throw, normally open, 1.2 amp at 12 VDC; sim to Stackpole Type SS-10.
S102	19B209066P1	Rotary: SPDT, 0.5 amp at 125 v; sim to Continental Wirt Type 126.
		- - - - - - - - - THERMAL BOARDS - - - - - - - - -
TB1	7487424P2	Miniature, phen: 1 terminal
TB3	7775500P26	Phen: 10 terminals.
TB4	7775500P107	Phen: 3 terminals.
TB5	7775500P10	Phen: 4 terminals.
TB6	7775500P46	Phen: 5 terminals
TB7	7775500P111	Phen: 8 terminals.
TB8	7487424P1	Miniature, phen: 1 terminal.
		- - - - - - - - - - TUBES - - - - - - - - - -
XV101 and XV102		Type 8106
XV103		Type 8994.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XV101 and XV102	7480533P8	Tube, phen: 9 pins; sim to Elco 04-903-84.
XV103	4029840P1	Tube, ceramic or steatite
		- - - - - - - - - - COILS - - - - - - - - - -
Z101	19B218309G1	Coil. Includes
C1	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
Z102	19B218309G2	Coil. Includes
C1	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.

MECHANICAL PARTS (RC-2172)

1	19B209532P9	Rivet. (Part of XY1-XY4).
2	4033089P1	Clip. (Part of XY1-XY4).
3	19A115793P1	Contact, electrical: sim to Malco 2700. (Part of XY1-XY4).
4	19C311172P2	Crystal socket. (Part of XY1-XY4).
5	19C303935G6	Chassis heat sink.
6	19C311518G1	Tuning slug. (Part of L108).
7	MS0813006C13	Screw, phillips head
8	4033304P35	Fiber washer.
9	19C311717G1	Tuning chassis.
10	19A121539P1	Plate
11	19A121006P8	Washer, aluminum. (Part of C122).
12	19A121018P2	Washer, teflon. (Part of C122).
13	787845SP1	Terminal, solderless. (Part of C122).
14	7165167P3	Tube shield insert. (Part of Y103- x quantity of 2 is required).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	G-E PART NO	DESCRIPTION
15	19B204793P2	Heat sink. (Lower) (Used with V103).
16	19B204792P1	Heat sink. (Upper) (Used with V103).
17	19C303599P1	Heat sink.
18	19A121523P1	Heat sink. (Used with V101 and V102).
19	19B205622P1	Spring. (Used with V101 and V102).
20	7165167P5	Tube shield insert: sim to Atlas 106-332-5. (Used with V101 and V102).
21	4031530P1	Bearing. (Part of Post assembly).
22	4031532P1	Cup washer. (Part of Post assembly).
23	19A127917P1	Post. (Part of Post assembly).
24	19B204395G3	Chassis.
25	4036555P1	Insulator disc: nylon. (Used with Q8 on A101-A112, A121-A126).
26	19A127896P2	Can. (Part of PA Plate Assembly).
27	19A127922P1	Spring. (Part of PA Plate Assembly).
28	19C303495G8	Station top cover. (Except Repeaters and VM).
	19C303673G3	Station top cover. (Repeaters and VM only).
	19C303396G1	Mobile top cover.
29	N81P15004C	Screw, phillips head: 8-32 x 1/4.
30	19A121676P1	Guide pin. (Used with J101).
31	19A128027G1	Bushing. (Part of PA Plate Assembly).
32	19A127900P1	Shaft. (Part of PA Plate Assembly).
33	19A127899P1	Disc. (Part of PA Plate Assembly).
34	4036899P33	Insulator stop.
35	N81P13004C6	Screw, phillips head: 8-32 x 1/4.
36	N81P9006C	Screw, phillips head: 4-40 x 3/8.
37	7115130P9	Lockwasher: sim to Shakeproof 1220-2. (Part of Post Assembly).
38	4031531P1	Locknut: No. 32. (Part of Post Assembly).
39	4031527P2	Collar. (Part of Post Assembly).
40	19C303605P1	Tuning cover.
41	N910P18C13	Retaining ring. (Part of Post Assembly).
42	7893938P1	Nut: No. 38. (Part of Post Assembly).
43	4031594P2	Insulator, teflon.
44	7878455P2	Terminal, solderless.
45	4029030P10	Channel, rubber.
46	19C303495G7	Station Bottom Cover.
	19C303396G3	Mobile Bottom Cover.
47	19A121065P1	Support. (Used with FL1, XFL1).
48	19A121257G1	Angle. (Used with FL1, XFL1).
49	N75P1006C13	Screw, machine: brass 0-80 x 3/8.
50	N207P1C13	Nut, brass: 0-80 thread.



PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for description of parts affected by these revisions.

REV. A thru E - (Exciter Board A101-106, A121-A126)

REV. A thru F - (Exciter Board A107-A112)
Incorporated into initial shipment

REV. A & B - (Channel Guard Low Pass Filter G101)
Incorporated into initial shipment

REV. A - (Channel Guard Encoder G102)
Incorporated into initial shipment

PARTS LIST

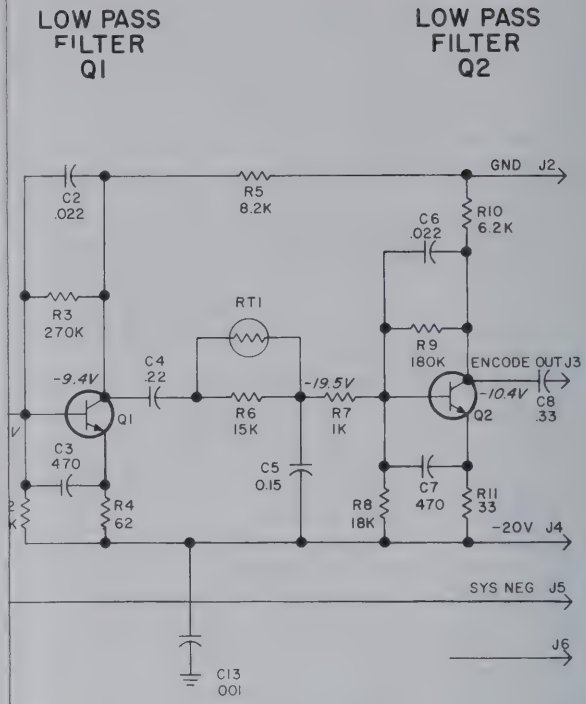
LBI-3936F

CHANNEL GUARD ENCODER G102
4EH17A10 19C311802G2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1*	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
		Earlier than REV A:
	19B209243P2	Polyester: 0.015 µf ±20%, 50 VDCW.
C2	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C3	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C5	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C6	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C7	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C8	19B209243P14	Polyester: 0.33 µf ±20%, 250 VDCW.
C9	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C10	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C11 thru C13	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115250P1	Silicon.
		- - - - - - - - - - TONE NETWORKS - - - - - - - -
FL1		TONE FREQUENCY NETWORK 19B205280
	19B205280G1	71.9 Hz
	19B205280G2	77.0 Hz
	19B205280G3	82.5 Hz
	19B205280G4	88.5 Hz
	19B205280G5	94.8 Hz
	19B205280G6	100.0 Hz
	19B205280G7	103.5 Hz
	19B205280G8	107.2 Hz
	19B205280G9	110.9 Hz
	19B205280G10	114.8 Hz
	19B205280G11	118.8 Hz
	19B205280G12	123.0 Hz
	19B205280G13	127.3 Hz
	19B205280G14	131.8 Hz
	19B205280G15	136.5 Hz
	19B205280G16	141.3 Hz
	19B205280G17	146.2 Hz
	19B205280G18	151.4 Hz
	19B205280G19	156.7 Hz
	19B205280G20	162.2 Hz
	19B205280G21	167.9 Hz
	19B205280G22	173.8 Hz
	19B205280G23	179.9 Hz
	19B205280G24	186.2 Hz
	19B205280G25	192.8 Hz
	19B205280G26	203.5 Hz
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J6	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 and Q2	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q3 thru Q5	19A115362P1	Silicon, NPN; sim to Type 2N2925.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBO
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
RT1
RT2
W1
XFL1
P130 thru P135



ALL RESISTORS ARE ½ WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K 1000 OHMS OR MEG 1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH MILLIHENRYS OR H HENRYS.

REVISION LTR BLOCK

		REV
G102	4EH17A10	A

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

SCHEMATIC & OUTLINE DIAGRAM

CHANNEL GUARD ENCODER G102
MODEL 4EH17A10

(311861, Rev. 3)
(311800, Sh. 1, Rev. 2)
(311800, Sh. 2, Rev. 2)

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service Parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When order a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

PARTS LIST

LBI-3936F

CHANNEL GUARD ENCODER G102
4EH17A10 19C311802G2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1*	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
		Earlier than REV A:
	19B209243P2	Polyester: 0.015 µf ±20%, 50 VDCW.
C2	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C3	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C5	19A116080P8	Polyester: 0.15 µf ±20%, 50 VDCW.
C6	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C7	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C8	19B209243P14	Polyester: 0.33 µf ±20%, 250 VDCW.
C9	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C10	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C11 thru C13	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115250P1	Silicon.
		- - - - - - - - - TONE NETWORKS - - - - - - - -
FL1		TONE FREQUENCY NETWORK 19B205280
	19B205280G1	71.9 Hz
	19B205280G2	77.0 Hz
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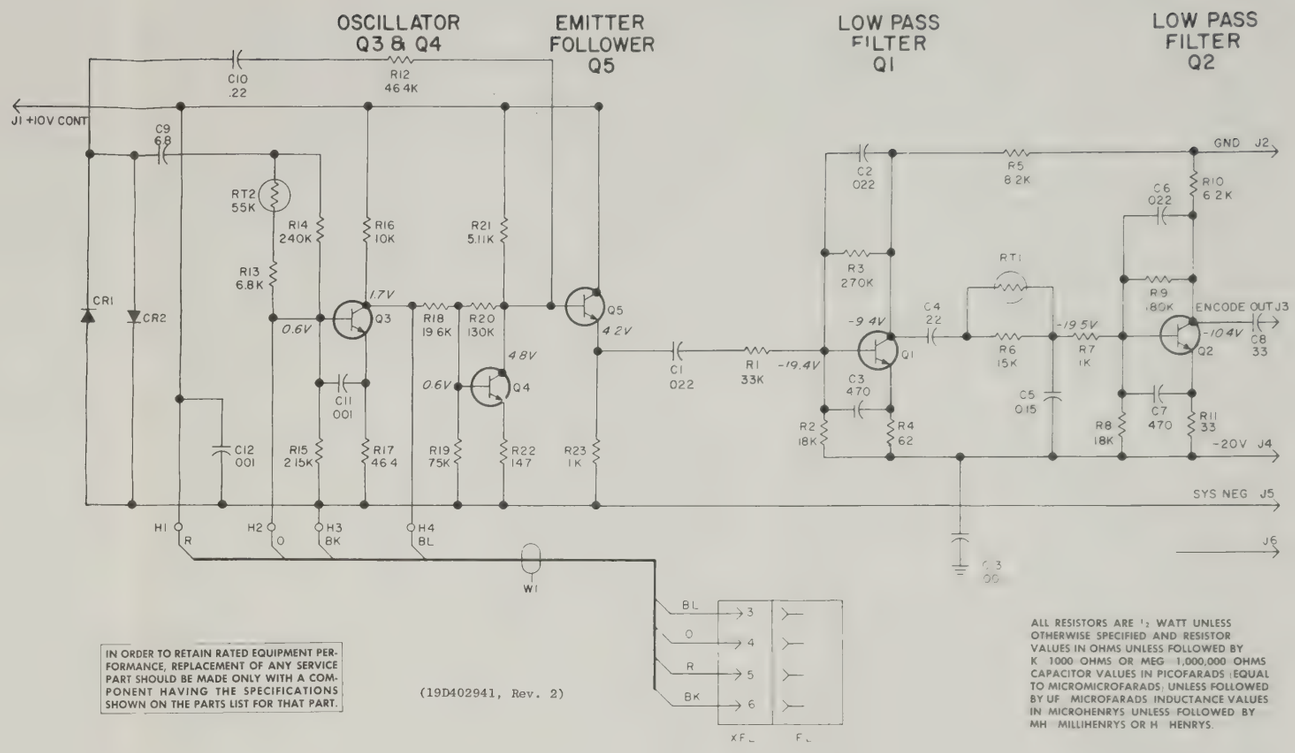
	19B205280G5	94.8 Hz
	19B205280G6	100.0 Hz
	19B205280G7	103.5 Hz
	19B205280G8	107.2 Hz
	19B205280G9	110.9 Hz
	19B205280G10	114.8 Hz
	19B205280G11	118.8 Hz
	19B205280G12	123.0 Hz
	19B205280G13	127.3 Hz
	19B205280G14	131.8 Hz
	19B205280G15	136.5 Hz
	19B205280G16	141.3 Hz
	19B205280G17	146.2 Hz
	19B205280G18	151.4 Hz
	19B205280G19	156.7 Hz
	19B205280G20	162.2 Hz
	19B205280G21	167.9 Hz
	19B205280G22	173.8 Hz
	19B205280G23	179.9 Hz
	19B205280G24	186.2 Hz
	19B205280G25	192.8 Hz
	19B205280G26	203.5 Hz
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J6	4033513P4	Contact, electrical; sim to Bead Chain L93-3.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 and Q2	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q3 thru Q5	19A115362P1	Silicon, NPN; sim to Type 2N2925.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P333K	Composition: 33,000 ohms ±10%, 1/2 w.
R2	3R77P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R3	3R77P274K	Composition: 0.27 megohms ±10%, 1/2 w.
R4	3R77P620J	Composition: 62 ohms ±5%, 1/2 w.
R5	3R77P822K	Composition: 8200 ohms ±10%, 1/2 w.
R6	3R77P153K	Composition: 15,000 ohms ±10%, 1/2 w.
R7	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R8	3R77P183K	Composition: 18,000 ohms ±10%, 1/2 w.
R9	3R77P184K	Composition: 0.18 megohms ±10%, 1/2 w.
R10	3R77P622J	Composition: 6200 ohms ±5%, 1/2 w.
R11	3R77P330K	Composition: 33 ohms ±10%, 1/2 w.
R12	19A116278P365	Metal film: 46,400 ohms ±2%, 1/2 w.
R13	3R77P682J	Composition: 6800 ohms ±5%, 1/2 w.
R14	3R77P244J	Composition: 0.24 megohm ±5%, 1/2 w.
R15	19A116278P233	Metal film: 2150 ohms ±2%, 1/2 w.
R16	19A116278P301	Metal film: 10,000 ohms ±2%, 1/2 w.
R17	19A116278P65	Metal film: 46.4 ohms ±2%, 1/2 w.
R18	19A116278P329	Metal film: 19,600 ohms ±2%, 1/2 w.
R19	19A116278P285	Metal film: 7500 ohms ±2%, 1/2 w.
R20	19A116278P412	Metal film: 130,000 ohms ±2%, 1/2 w.
R21	19A116278P269	Metal film: 5110 ohms ±2%, 1/2 w.
R22	19A116278P117	Metal film: 147 ohms ±2%, 1/2 w.
R23	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
		- - - - - - - - - THERMISTORS - - - - - - - -
RT1	5490828P30	Thermistor: 330,000 ohms ±10%, color code black and gray; sim to Globar Type 783H-3.
RT2	5490828P36	Thermistor: 55,000 ohms ±10%, color code black and red; sim to Globar Type 723B.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1		(Part of XFL1).
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XFL1	19A12192G3	Reed, mica-filled phen: 7 pins rated at 1 amp at 500 VRMS with 4-1/4 inches of cable.
		ENCODER INSTALLATION KIT 19A127174G1
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	N404P13C13	Lockwasher, no. 6.
	N80P13005C13	Machine screw, no. 6-32 x 5/16.
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4.
	N210P13C13	Nut, no. 6-32.
	19B20548OG2	Harness. Includes:
P130 thru P135	4029840P2	Contact, electrical; sim to Amp 42827-2.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SCHEMATIC DIAGRAM



IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19D402941, Rev. 2)

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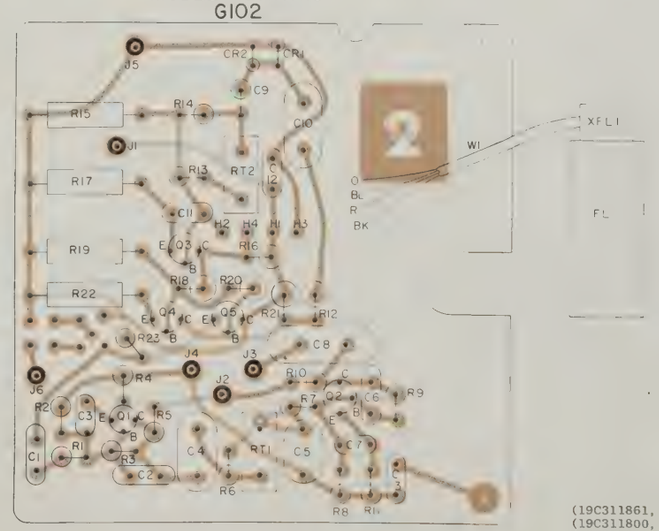
REVISION LTR BLOCK

		REV
G102	4EH17A10	A

OUTLINE DIAGRAM

ENCODER
MODEL 4EH17A10
G102



RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

(19C311861, Rev. 3)
(19C311800, Sh. 1, Rev. 2)
(19C311800, Sh. 2, Rev. 2)

SCHEMATIC & OUTLINE DIAGRAM

CHANNEL GUARD ENCODER G102
MODEL 4EH17A10

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MAINTENANCE MANUAL

LBI-4267

DF-3125

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

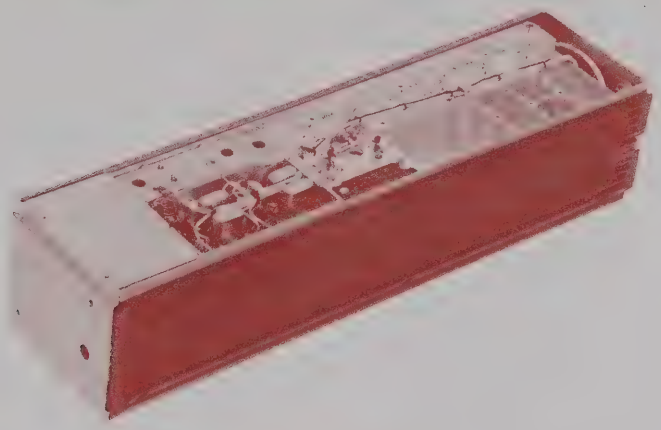
GENERAL ELECTRIC

PRINTED IN U.S.A.

MOBILE RADIO

MASTR Progress Line

132—174 MHZ RECEIVER MODELS 4ER41C10—21, 34—45 & 4ER41E10—21, 34—45 (Includes Options 7341—7344)



SPECIFICATIONS *

	ER-41-C & E	
FCC Filing Designation		
Frequency Range	132—174 MHz	
Audio Output	5 watts at less than 5% distortion	
Sensitivity	Standard Receivers	Ultra-High Sensitivity Receivers
12-dB SINAD (EIA Method)	0.35 μV	0.175 μV
20-dB Quieting Method	0.5 μV	0.25 μV
Selectivity		
EIA Two-Signal Method	-90 dB (adjacent channel, 30 kHz channels)	
20-dB Quieting Method	-100 dB at ±15 kHz	
Spurious Response		
Standard Receiver	-100 dB	
UHS Receiver	-94 dB	
First Oscillator Stability		
Type ER-41-C	±.0005% (-30°C to +60°C)	
Type ER-41-E	±.0002% (-30°C to +60°C)	
Modulation Acceptance	±7 kHz (narrow-band)	
Squelch Sensitivity		
Critical Squelch		
Standard Receiver	0.2 μV	
UHS Receiver	0.1 μV	
Maximum Squelch	Greater than 20-dB quieting (less than 1.5 μV)	
Intermodulation (EIA)		
Standard Receiver	-80 dB	
UHS Receiver	-75 dB	
Maximum Frequency Separation	0.4%	
Frequency Response	+1 and -8 dB of a standard 6-dB per octave de-emphasis curve from 300 to 3000 Hz (1000-Hz reference)	

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

ER-41-C & E

GENERAL ELECTRIC

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WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

General Electric MASTR Progress Line Receiver Types ER-41-C and ER-41-E are double conversion, superheterodyne FM receivers designed for operation on the 132-174 megahertz band. The Type ER-41-C receivers contain a standard crystal oscillator board with a frequency stability of ±0.0005%. The Type ER-41-E receivers contain an optional Integrated Circuit Oscillator Module (ICOM) with a frequency stability of ±0.0002%. Standard and ultra-high sensitivity (UHS) versions are available for both types.

The receiver is of single-unit construction and is completely housed in an aluminum casting for maximum shielding and rigidity. The top compartment of the casting contains the RF, oscillator, converter, and 1st amplifier stages. The bottom portion of the casting contains the IF audio and squelch board, and the optional Channel Guard encode-decode board.

CIRCUIT ANALYSIS

The MASTR Progress Line Receiver is completely transistorized, using silicon transistors throughout for added reliability. Input leads to the receiver are individually filtered by the 20-pin feed-through by-pass connector J443. A regulated +10 Volts is used for all receiver stages except the audio PA stage which operates from the 12-Volt system supply.

Centralized metering jack J442 is provided for use with General Electric Test Set Models 4EX3A10 or 4EX8K10, 11 for ease of alignment and servicing. The Test Set meters the oscillator, multiplier, and limiter stages as well as the discriminator, and regulated 10 Volts.

RF PREAMPLIFIER (A321)

RF Preamplifier A321 is used only in ultra-high sensitivity (UHS) receivers and consists of RF Amplifier Q12.

The preamplifier uses a dual gate MOS FET as the active device. The MOS FET may be considered a semiconductor current path (or channel) whose resistance is varied by a voltage applied between the "gate" and "source" terminals.

RF from the antenna is coupled through C1 to Gate 1 terminal of MOS FET Q12. Q12 operates as a grounded-gate amplifier.

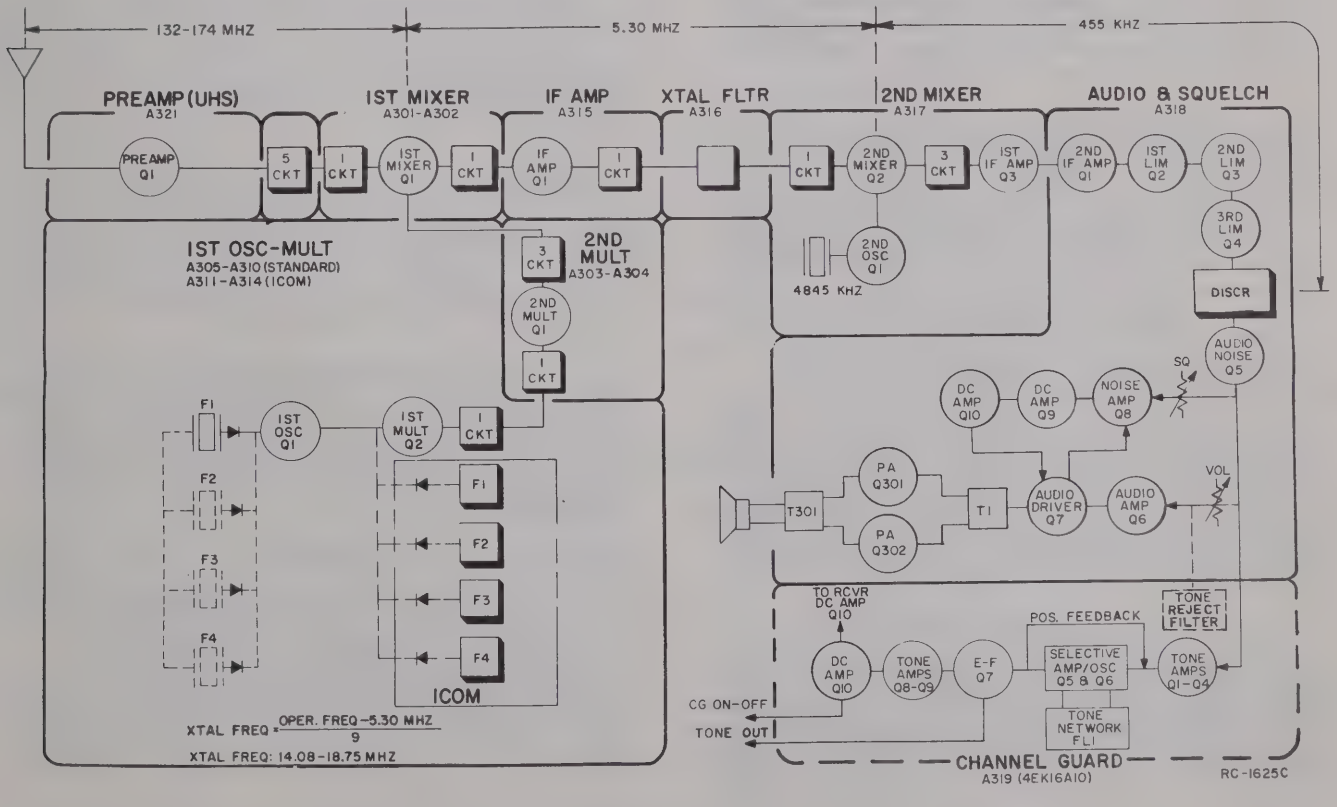

Figure 1 - Receiver Block Diagram

This method of operation provides a low impedance input to the amplifier. The amplified output is taken from the "drain" terminal and coupled through C6 to the input of five helical resonators.

HELICAL RESONATORS

In standard receivers, five helical resonators (L301/L302 through L309/L310) provide the RF selectivity in the front end. RF cable W441 connects the RF signal from the antenna to a tap on L301/L302. In UHS receivers, the five helical resonators provide additional RF selectivity of the signal from the amplifier.

The tap on L301/L302 is positioned to provide the proper impedance match to the antenna or preamplifier. The output of the helical resonators is coupled through C3 to the 1st Mixer Assembly.

STANDARD OSCILLATOR/MULTIPLIER (A305-A310)

The receiver 1st oscillator operates in a transistorized Colpitts oscillator circuit. The oscillator crystal operates in a fundamental mode at a frequency of approximately 13 to 18 megahertz. The crystal is cut to provide temperature compensation at the high end of the temperature range and is thermistor compensated at low temperatures. This provides ±.0005% frequency stability as soon as the receiver is energized--without the warm-up time required by crystal ovens or warmers.

In single frequency receivers, bias for the oscillator transistor is obtained by a jumper from H1 to H2 on the oscillator board.

In multi-frequency receivers, a diode is connected in series with the crystal, and up to three addition crystal circuits can be added. The 10-Volt jumper is removed and the proper frequency is selected by switching the desired crystal circuit to +10 Volts by means of a frequency selector switch on the control unit.

Switching the +10 Volts to the crystal circuit forward biases the diode and reduces its impedance. This applies the crystal frequency to the base of oscillator transistor Q1. Feedback for the oscillator is developed across C21. The output is coupled to the base of 1st multiplier Q2.

The output of the 1st multiplier (tripler Q2) is transformer-coupled (T1/T2) to the 2nd multiplier assembly. The 1st multiplier tank is tuned to three times the crystal frequency, and is metered at centralized metering jack J442-4 through metering network CR5, R16, R5 and C33.

OSCILLATOR/MULTIPLIER BOARD WITH ICOM (Options 7341 - 7344)

Oscillator/Multiplier Boards A311 thru A314 use ICOM Module Model 4EG26A11. See the chart below:

OSCILLATOR BOARD	OPTION NUMBER	NUMBER OF FREQUENCIES
A311	7341	1
A312	7342	2
A313	7343	3
A314	7344	4

The ICOM Module consists of a crystal controlled Colpitts oscillator, a voltage regulator and a buffer output stage. The entire module (including crystal) is enclosed in a dust proof aluminum can, with the ICOM frequency and the receiver operating frequency printed on the top. Access to the oscillator trimmer is obtained by prying off the plastic GE decal on the top of the can.

The oscillator frequency is temperature-compensated at both ends of the temperature range to provide instant frequency compensation, with a frequency stability of ±0.0002% without crystal ovens or warmers.

In single-frequency receivers, +10 Volts for operating the ICOM is obtained by a jumper from H1 to H2. With the ICOM operating, diode CR1 is forward biased and the oscillator output is applied to 1st multiplier Q2.

The output of the 1st multiplier (tripler Q2) is transformer-coupled (T1/T2) to the 2nd multiplier assembly. The 1st multiplier tank is tuned to three times the crystal frequency, and is metered at centralized metering jack J442-4 through metering network CR5, R16, R5 and C33.

In multi-frequency receivers, up to three additional ICOM modules can be plugged into the board. The 10-Volt jumper is removed and the proper frequency is selected by switching the desired ICOM to +10 Volts by means of a frequency selector switch on the control unit.

CAUTION

All ICOM modules are individually compensated at the factory, and cannot be repaired in the field. Any attempt to remove the ICOM cover will void the warranty.

2ND MULTIPLIER (A303/A304)

The 1st multiplier output is transformer-coupled through A303-T1/T2 to the base of 2nd multiplier A303-Q1. Following the 2nd multiplier are two resonant L-C circuits and a helical resonator tuned to nine times the crystal frequency. The output is taken from a tap on L311/L312 and applied to the 1st mixer.

1ST MIXER (A301/A302)

The 1st mixer uses a Field-Effect Transistor (FET) as the active device. (Fig. 2).

The FET has several advantages over a conventional transistor, including a high input impedance, high power gain, and an output that is relatively free of harmonics (low in intermodulation products).

In mixer A301/A302, RF from the helical resonators is applied to the gate of Q1, and injection voltage from the 2nd multiplier is applied to the source. The mixer output is taken from the drain with the output tuned to the 5.3 MHz high IF frequency.

The FET has voltage-controlled characteristics, and may be compared to a vacuum tube in operation (see Figure 2B).

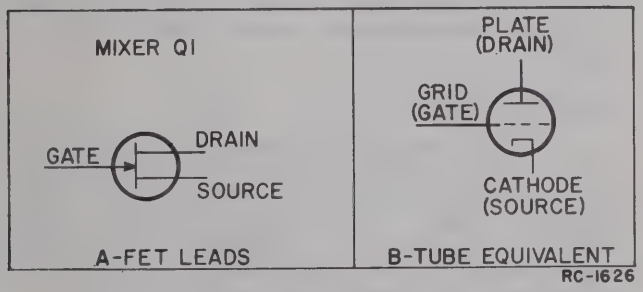

Figure 2 - FET Nomenclature

HI IF AMPLIFIER (A315) and CRYSTAL FILTER (A316)

A series-resonant circuit (A301-L3 and A315-C1) couples the mixer output to the emitter of the high IF amplifier A315-Q1. The transistor is connected as a grounded-base amplifier which provides a low impedance for the mixer input. The amplifier output is coupled through a transformer T1 to the crystal filter.

The highly selective crystal filter (A316) provides the major selectivity for the receiver. The output of the filter is coupled through impedance-matching transformer A317-T1 to the base of the 2nd mixer.

2ND OSCILLATOR, 2ND MIXER AND 1ST LO IF AMPLIFIER (A317)

A317-Q2 operates in a Colpitts oscillator circuit, with feedback supplied through C4. The oscillator low-side injection voltage (4845 kHz) is applied to the base of the 2nd mixer.

The High IF signal from the filter and the injection voltage from the 2nd oscillator is applied to the base of 2nd mixer Q2. The 445-kHz mixer output is applied to three tuned low IF circuits, L1, L2 and L3. These tuned circuits are required for shaping the nose of the IF waveform, and for rejecting any undesired output frequencies from the 2nd mixer.

The low IF signal is applied to the base of 1st low IF amplifier Q317-Q3. The output of A317-Q3 is R-C coupled to the base of the 2nd low IF amplifier.

2ND LO IF AMPLIFIER AND LIMITERS (A318)

Additional amplification of the low IF signal going to the limiter stages is provided by 2nd low IF amplifier A318-Q1. This stage is metered at J442-2 through a metering network consisting of C19, CR3 and R25.

Following the 2nd low IF amplifier are three R-C coupled limiter stages (A316-Q2, -Q3 and -Q4). The 1st limiter is metered at J442-3 through metering network C20, CR4 and R26.

DISCRIMINATOR (A318)

The limiter output is applied to a Foster-Seely type discriminator, where diodes CR1 and CR2 rectify the 455-kHz signal to recover the audio. The discriminator is metered at J442-10 through metering network C16 and R23.

AUDIO - NOISE AMPLIFIER (A318)

The discriminator output is coupled through a low-pass filter (C16, C18, R21 and R22) to the base of audio-noise amplifier Q5. The filter removes any 455-kHz signal remaining in the discriminator output. Q5 operates as a emitter-follower to match the discriminator impedance to the VOLUME control, SQUELCH control, and Channel Guard input. The stage also provides power gain.

AUDIO AMPLIFIERS (A318)

Any audio present in the incoming signal is coupled from the emitter of Q5 through the VOLUME control and a de-emphasis network to the base of audio amplifier Q6. The de-emphasis network consists of C22, C23, C24, R30 and R31.

Audio driver Q7 follows the audio amplifier. The output of Q7 is coupled through transformer T1 to provide phase inversion for the push-pull audio PA stage.

Q301 and Q302 operate as a push-pull, Class AB audio PA stage. The PA output is coupled through audio transformer T301 to the loudspeaker. The yellow and white tertiary windings of T301 supply balanced feedback to the collector of Q7 to minimize distortion.

Base bias for the PA stage and the elimination of crossover distortion is controlled by bias adjust potentiometer R43. The potentiometer is set at the factory as shown in STEP 1 of the receiver Test Procedure.

NOTE

Do not adjust bias adjust potentiometer R43 unless PA transistors Q301 and Q302 have been replaced.

Audio high and low are also present at centralized metering jack J442, and can be used as shown in STEP 1 of the receiver Test Procedure. The output stage provides 5 Watts at less than 5% distortion into a 3.5-ohm load at the receiver output terminals (3.2-ohm load at the Control Unit).

SQUELCH (A318)

Noise from the audio-noise amplifier operates the squelch circuit. With no carrier present in the receiver, this noise is coupled to the base of noise amplifier Q8 through a high-pass filter which attenuates frequencies below 3 kHz. The filter consists of C30, C31 and R45, as well as C34 and L3 in the collector circuit of Q8. The gain of Q8 is determined by the Squelch control, which varies the bias on the base of Q8. Thermistor RT2 keeps the critical squelch constant over wide variations in temperature.

The output of noise amplifier Q8 is rectified by diodes CR5 and CR6, and filtered by C36 and C37 to produce a negative DC voltage. This DC voltage is applied to the base of DC amplifier Q9, turning it off. When turned off, the collector voltage of Q9 rises to approximately 8 Volts, turning on DC amplifier Q10. When conducting, the collector voltage of Q10 drops to almost ground potential, which removes the base bias to audio amplifier Q6 and audio driver Q7, turning them off.

When the receiver is quieted by a signal (unsquelches), the noise in the receiver is reduced, turning DC amplifier Q9 on and DC amplifier Q10 off. This allows the audio stages to conduct so that sound is heard in the speaker. A network composed of C38, CR7 and R62 slows down the switching action of Q10, preventing an obnoxious "thump" from being heard in the speaker.

Resistor R53 connects from the emitter of audio driver Q7 to the emitter of noise amplifier Q8, providing a hysteresis loop in the squelch circuit. When a weak signal opens the squelch, the signal level may be reduced by 4 to 6 dB without the squelch closing. This limits squelch "flutter" or "picket-fence" operation.

With audio driver Q7 conducting, a positive voltage through R53 helps to reduce the gain of noise amplifier Q8. This positive feedback provides a quick, positive switching action in the squelch circuit. When the receiver squelches, audio driver Q7 turns off and its emitter potential drops to zero. This reduces the DC feedback through R53 to the emitter of noise amplifier Q8. Reducing the feedback causes Q8 to conduct harder, turning the audio stages off quickly.

Keying the transmitter removes the +10 Volts from J19, turning off DC amplifier Q9 and turning on Q10 to mute the receiver.

CHANNEL GUARD

Channel Guard Board Model 4EK16A10 is a fully transistorized encoder-decoder for use in the MASTR Professional Series mobile and station combinations. The tone frequencies are controlled by plug-in tone networks that are made with precision components for excellent stability and reliability. The tone frequencies range from 71.9 to 203.5 Hz.

Encoder (A319)

Keying the transmitter removes the receiver mute +10 Volts, and forward biases feedback control diode CR5, causing it to conduct. When conducting, the diode shunts R39 which reduces the impedance of the positive feedback loop (R39, R35 and C19). This provides the necessary gain to the base of Q5 to permit oscillation.

The encoder tone is provided by selective amp-oscillator transistors Q5 and Q6 which oscillate at a frequency determined by the tone network. Negative feedback applied through the tone network to the base of Q5 prevents any gain in the stage except at the desired encode frequency.

Starting network R45, C21, C22 and CR6 provide an extremely fast starting time for the encoder tone. Keying the transmitter removes the receiver mute +10 Volts, causing a pulse to be applied to the base of Q6 to quickly start the oscillator. Thermistor-resistor combination R32 and RT1 provides temperature compensation for the oscillator output. Limiter diodes CR3 and CR4 keep the tone amplitude constant.

Emitter-follower Q7 follows the oscillator circuit. The encoder tone is taken from the emitter of Q7 and applied to an active low-pass filter (G101) on the transmitter.

Decoder (A319)

The decoder function is designed to eliminate all calls that are not tone coded for the Channel Guard frequency. As long as the CHANNEL GUARD-OFF switch on the control unit is left in the CHANNEL GUARD position, all signals are locked out except those from transmitters that are continuously tone coded for positive identification by the receiver.

Placing the CHANNEL GUARD-OFF switch in the OFF position instantly disables the Channel Guard operation so that all calls on the channel can be heard. When the hookswitch option is used, lifting the microphone from its hanger disables the Channel Guard Circuit.

Audio, tone and noise are taken from the emitter of the receiver audio-noise amplifier A318-Q5 and is fed through A319-J1 to four tone amplifier and bandpass filter circuits. The filters remove the audio and high-frequency noise from the signal, and the tone amplifiers provide sufficient gain to insure clipping by limiter diodes CR1 and CR2. The clipping action eliminates variation in the squelch performance due to changes in tone deviation. The signal is then applied to selective amplifiers Q5 and Q6 which amplify only the tone determined by the tone network.

The output of the selective amplifier is applied through emitter-follower Q7 to the high gain, broad-band tone amplifiers Q8 and Q9. The output of Q9 is rectified by detector diodes CR7 and CR8, and the resulting negative DC voltage controls the squelch gate. Q8 is normally biased for low gain. When the tone is detected by CR7 and CR8, feedback is provided through R54 to quickly change the bias on Q8 for full gain. This ensures a more positive "unsquelching" action.

Squelch gate diode CR9 is normally forward biased by a positive DC voltage (approximately 1.5 volts) fed through R58. The forward bias causes CR9 to conduct, feeding a DC voltage to the base of DC amplifier A318-Q10 in the receiver. This removes the bias on the receiver audio stages and holds them off.

When the proper tone is applied to the decoder, the negative DC voltage from the detector diodes back-biases squelch gate diode CR9 and cuts off the positive bias to the receiver DC amplifier A318-Q10. However, the receiver noise squelch circuit continues to operate until a carrier quiets the receiver.

Placing the CHANNEL GUARD - OFF switch in the OFF position (or removing the microphone from its hookswitch) removes the ground to the base of the decoder DC switch (Q10), causing it to conduct. This back-biases squelch control diode CR9 and cuts off the positive bias to the receiver DC amplifier (A318-Q10). The receiver noise squelch circuit continues to operate until a carrier quiets the receiver.

A tone rejection filter connected in parallel with A318-J2 (in the receiver bypasses any incoming tone to ground. This attenuates the tone level reaching the receiver audio circuits. The filter is composed of C26, C27, C28, C29, L1 and R59.

An optional tone reject filter (A320) that is identical to the filter described above is available for use in two-way radios with transmitter Channel Guard only.

MAINTENANCE

DISASSEMBLY

To service the receiver from the top—

1. Pull locking handle down and pull radio about one inch out of mounting frame.
2. Pry up cover at rear of receiver.
3. Slide cover back and lift off.

To service the receiver from the bottom—

1. Pull locking handle down. Pull radio out of mounting frame.
2. Remove screws in bottom cover. Pry up cover at back of receiver.
3. Slide cover back and lift off.

To remove the receiver from the system frame—

1. Loosen the two Phillips-head retaining screws in front casting (see Figure 3), and pull casting away from system frame.
2. Remove the four screws in the back cover.
3. Remove the two screws holding the receiver at each end of the system frame.
4. Disconnect the antenna jack and the 20-pin connector from the front of the receiver, and slide the unit out of the system frame.

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MAINTENANCE

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2. Pry up cover at rear of receiver.
3. Slide cover back and lift off.

To service the receiver from the bottom—

1. Pull locking handle down. Pull radio out of mounting frame.
2. Remove screws in bottom cover. Pry up cover at back of receiver.
3. Slide cover back and lift off.

To remove the receiver from the system frame—

1. Loosen the two Phillips-head retaining screws in front casting (see Figure 3), and pull casting away from system frame.
2. Remove the four screws in the back cover.
3. Remove the two screws holding the receiver at each end of the system frame.
4. Disconnect the antenna jack and the 20-pin connector from the front of the receiver, and slide the unit out of the system frame.

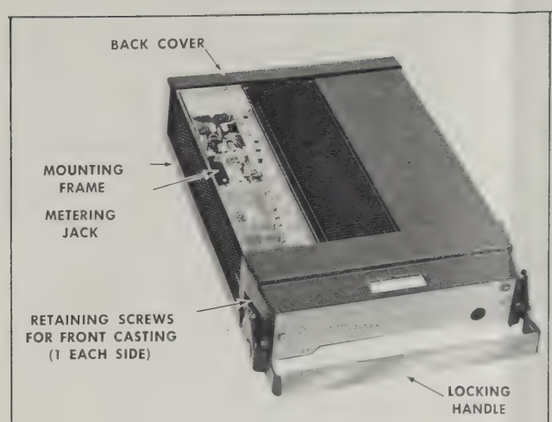


Figure 3 - Removing Top Cover

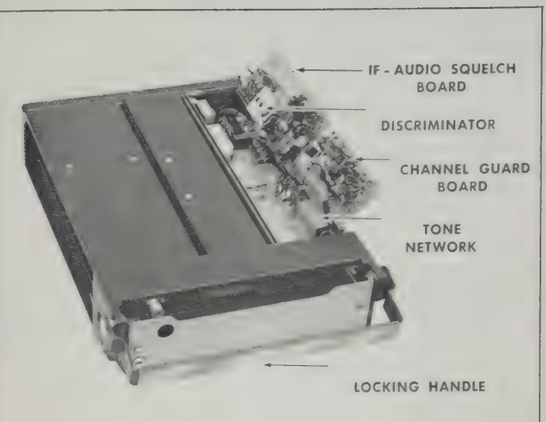
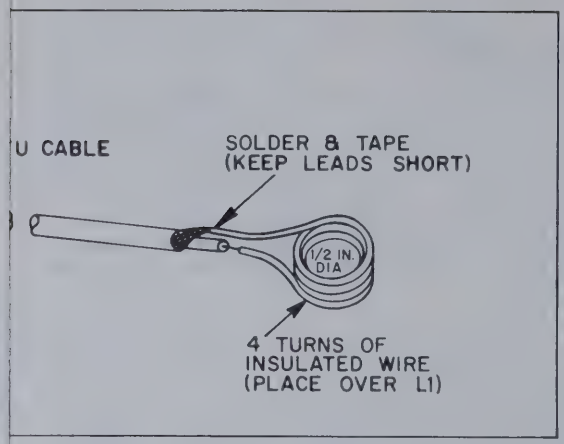
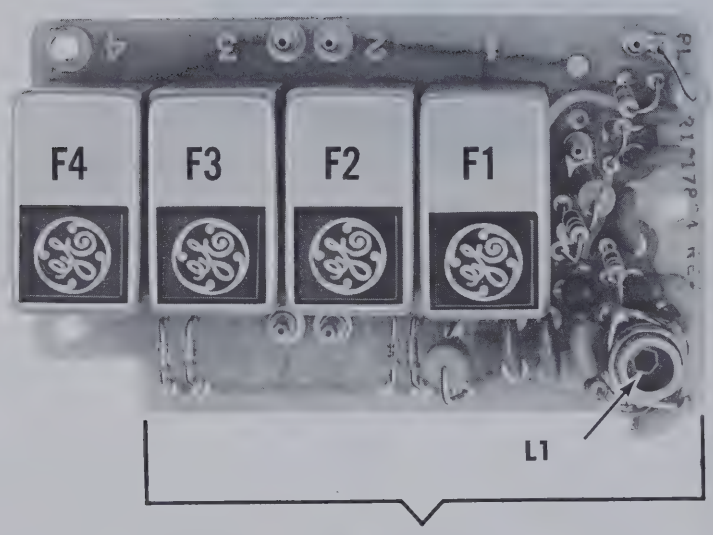


Figure 4 - Removing Bottom Cover

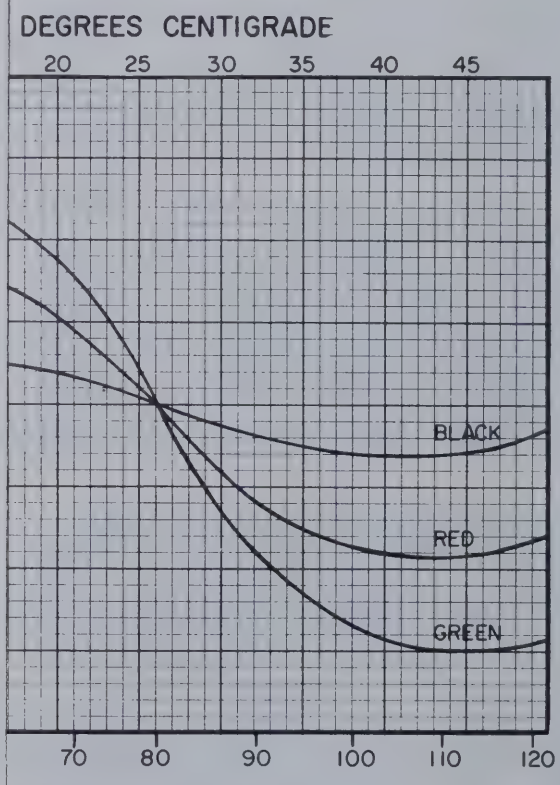


RC-1779

axial Cable and Test Loop



1ST OSC MULT. (ER-41-E)



RC-1599

6 - ICOM Correction Curves

ADJUSTMENT PROCEDURE

ICOM ADJUSTMENT
MODELS 4ER41E10-45

GNMENT

-Volt multimeter.

ect a one-inch piece of insulated wire no

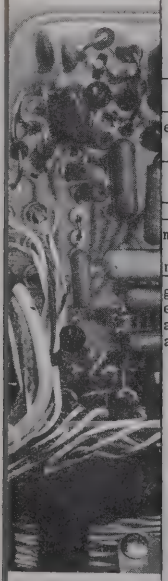
itch to the TEST 1 or 1-Volt position.

n 1st OSC/MULT board (A305-A310 only) to
ed.

ign the unit on channel F1. If the

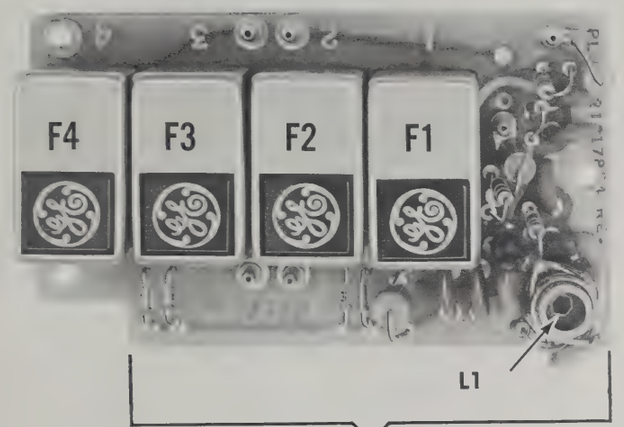
from C312 to C313.

PROCEDURE
d swing open the IF-AUDIO & SQUELCH board. Adjust turn counterclockwise from the bottom of coil. signal to J2 and J4 and adjust L2 (disc secondary) .
0-kHz and 460-kHz signal and check for readings but not more than 0.5 Volt on GE Test Set. Both n .05 Volt. Do not attempt to balance reading olt.
for maximum meter reading. Then tune L1 meter reading.
for L1 and L2 (2nd MULT) for maximum meter (2nd MULT) for minimum meter reading.
signal into Hole 305. Adjust the signal nator zero.
signal as above. Tune L2, L3 and C306 for keeping signal below saturation.
signal into Hole 304, and tune L2 and L1 for keeping signal below saturation.
signal in the Hole shown below, keeping the n. Tune C302 through C305 for maximum meter : In: Tune C305 C304 C303 C302
e no further adjustment. If adjustment is
helpful suggestions on how to
modulated signal and tune L3, L2, L1, T1 IF AMP) for maximum meter reading, keeping n.
generator, and detector as shown in Figure 7. evel for 30-50 μv and modulate with 10 kHz at at the collector of Q3 (2nd Mixer board output), as shown on scope pattern.
riminator idling voltage is within ±.05 Volt of plied. Check to see that modulation acceptance 7 and 9 kHz.
signal to the antenna jack. Tune C9 for zero In multi-frequency units tune C10, C11 or C12 — NOTE — control of the receiver, it is recommended djustments be made with the equipment at a ximately 75°F. In no case should frequency when the equipment is outside the tempera- 90°F.



ALIGNMENT PROCEDURE

132—174 MHz MASTR RECEIVER
MODELS 4ER41C10-45 &
4ER41E10-45



1ST OSC MULT. (ER-41-E)

ICOM FREQUENCY ADJUSTMENT

Due to the high stability of the ICOM module, it is not recommended that zero discriminator be used as the indication for setting the oscillator frequency. Instead, measure the ICOM frequency as described in the following procedure.

EQUIPMENT REQUIRED:

1. Frequency Counter capable of measuring the 42 to 56.25 MHz frequency range. The counter should have an accuracy of 0.4 part-per million (PPM).
2. Coaxial cable with test loop as described in Figure 15.
3. Mercury thermometer.

PROCEDURE:

1. Check ICOM temperature by taping the mercury thermometer to the side of the ICOM.
2. Connect the coaxial cable to the frequency counter. Then place the 4-turn test loop over L1 on the 1st OSC/MULT board.
3. If the ICOM temperature is 80°F (±4°F) or 26.5°C (±2°C), the frequency indication on the counter should be 3 times the frequency stenciled on the ICOM case. Adjust the ICOM trimmer (if necessary) to obtain this frequency.
4. If the temperature is not within the 80°F (±4°F) or 26.5°C (±2°C) range, use the correction curves of Figure 6 for setting the ICOM frequency as follows:
   a. Check the color dot beneath the GE emblem and select the matching curve to determine the correction factor in parts-per-million (PPM).
   b. Multiply the frequency stenciled on the ICOM by 3 and then multiply this figure by the correction factor (from Figure 6) observing the sign (±) given to the correction factor.
   c. The frequency measured at L1 should be 3 times the ICOM frequency ± the correction factor. Adjust the ICOM trimmer (if required) to obtain this frequency.

EXAMPLE

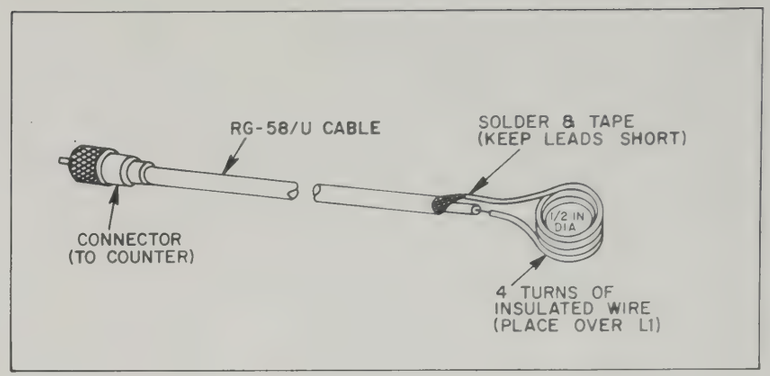
ICOM Frequency	-	16.948,148 MHz
ICOM Color Dot	-	Green
Ambient Temperature	-	35°C (95°F)
Correction Factor	-	-1.15 PPM

Multiply ICOM Frequency by 3; (16.948,148 MHz x 3 = 50.844,444 MHz)

Multiply preceding figure by correction factor; (50.844 MHz x -1.15 PPM = -58.47 hertz (or -58 hertz)

Set the frequency measured at L1 for 50.844,386 MHz;

```
50.844,444
-       58
----------
50.844,386
```



RC-1779

Figure 5 - Coaxial Cable and Test Loop

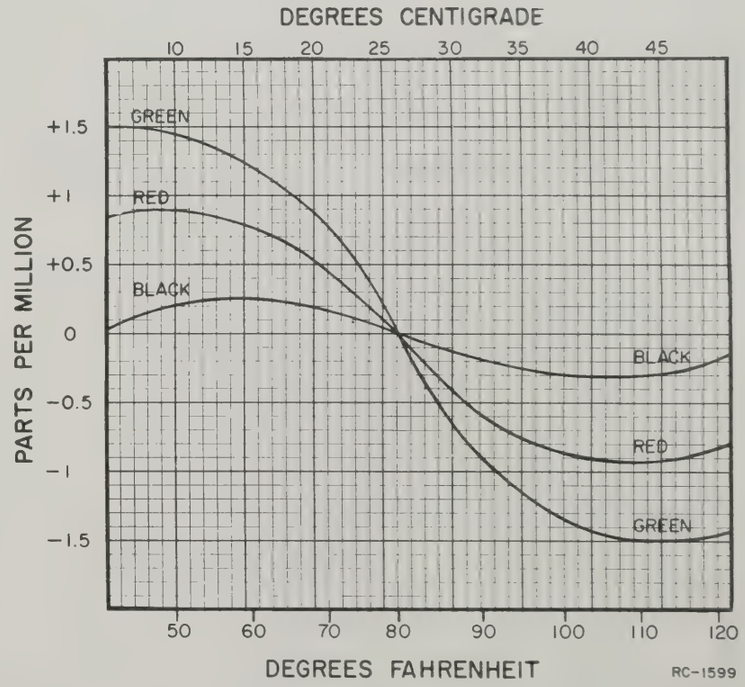


Figure 6 - ICOM Correction Curves

ADJUSTMENT PROCEDURE

ICOM ADJUSTMENT
MODELS 4ER41E10-45

FRONT END ALIGNMENT

EQUIPMENT REQUIRED

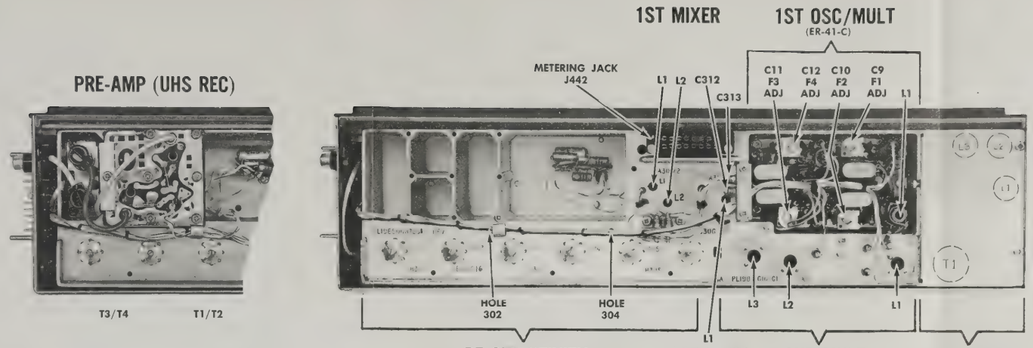
1. GE Test Set Model 4EX3A10, 4EX8K10, 11, station test meter panel or 20,000 ohms-per-Volt multimeter.
2. A 132-174 MHz signal source. Connect a one-inch piece of insulated wire no larger than 0.065 inch to generator output probe.

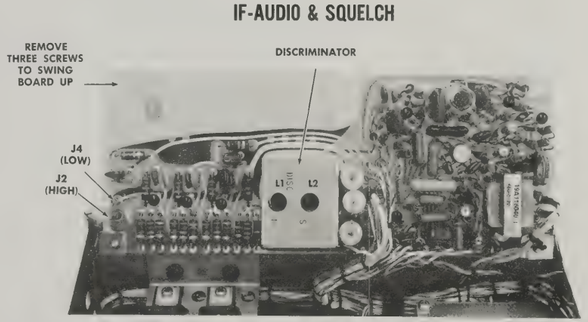
PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect Test Set to receiver centralized metering jack J442 and set meter sensitivity switch to the TEST 1 or 1-Volt position.
2. With Test Set in position J, check for regulated +10 Volts. If using Multimeter, measure from C312 to C313.
3. If using Multimeter, connect the positive lead to J442-16 (ground).
4. Disable the Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION: GE Test Set or Meter Panel	METERING POSITION: Multimeter - at J442	TUNING CONTROL	METER READING	PROCEDURE
			OSCILLATOR AND MULTIPLIERS		
1.	D (MULT-1)	Pin 4	L1 (on 1st OSC/MULT) and L1 (on 2nd MULT)	See Procedure	Tune L1 (1st OSC/MULT) for maximum meter reading. Then tune L1 (2nd MULT) for minimum meter reading.
2.	E (MULT-2)	Pin 5	L1 (on 1st OSC/MULT) and L1, L2 and L3 (on 2nd MULT)	See Procedure	Tune L1 (1st OSC/MULT) and L1 and L2 (2nd MULT) for maximum meter reading. Then tune L3 (2nd MULT) for minimum meter reading.
3.	A (DISC)	Pin 10		Zero	Apply an on-frequency signal into Hole 305. Adjust the signal generator for discriminator zero.
4.	B (2nd IF AMP)	Pin 2	L2 and L3 (on 2nd MULT) and C306 (on RF selectivity)	Maximum	Apply an on-frequency signal as above. Tune L2, L3 and C306 for maximum meter reading, keeping signal below saturation.
			FREQUENCY ADJUSTMENT		
5.	A (DISC)	Pin 10	C9 on 1st OSC/MULT (C10, C11 and C12) for multi-frequency	Zero	Apply an on-frequency signal to the antenna jack. Tune C9 for zero discriminator reading. In multi-frequency units, tune C10, C11 and C12 as required. —— NOTE —— For proper frequency control of the receiver, it is recommended that all frequency adjustments be made when the equipment is at a temperature of approximately 75°F. In no case should frequency adjustments be made when the equipment is outside the temperature range of 50° to 90°F.





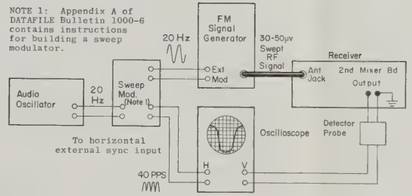


Figure 7 - Test Setup for 20-Hz Double-Trace Sweep Alignment

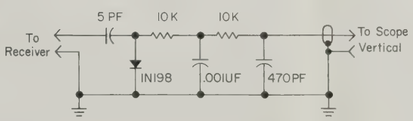


Figure 8 - Detector Probe for Sweep Alignment

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

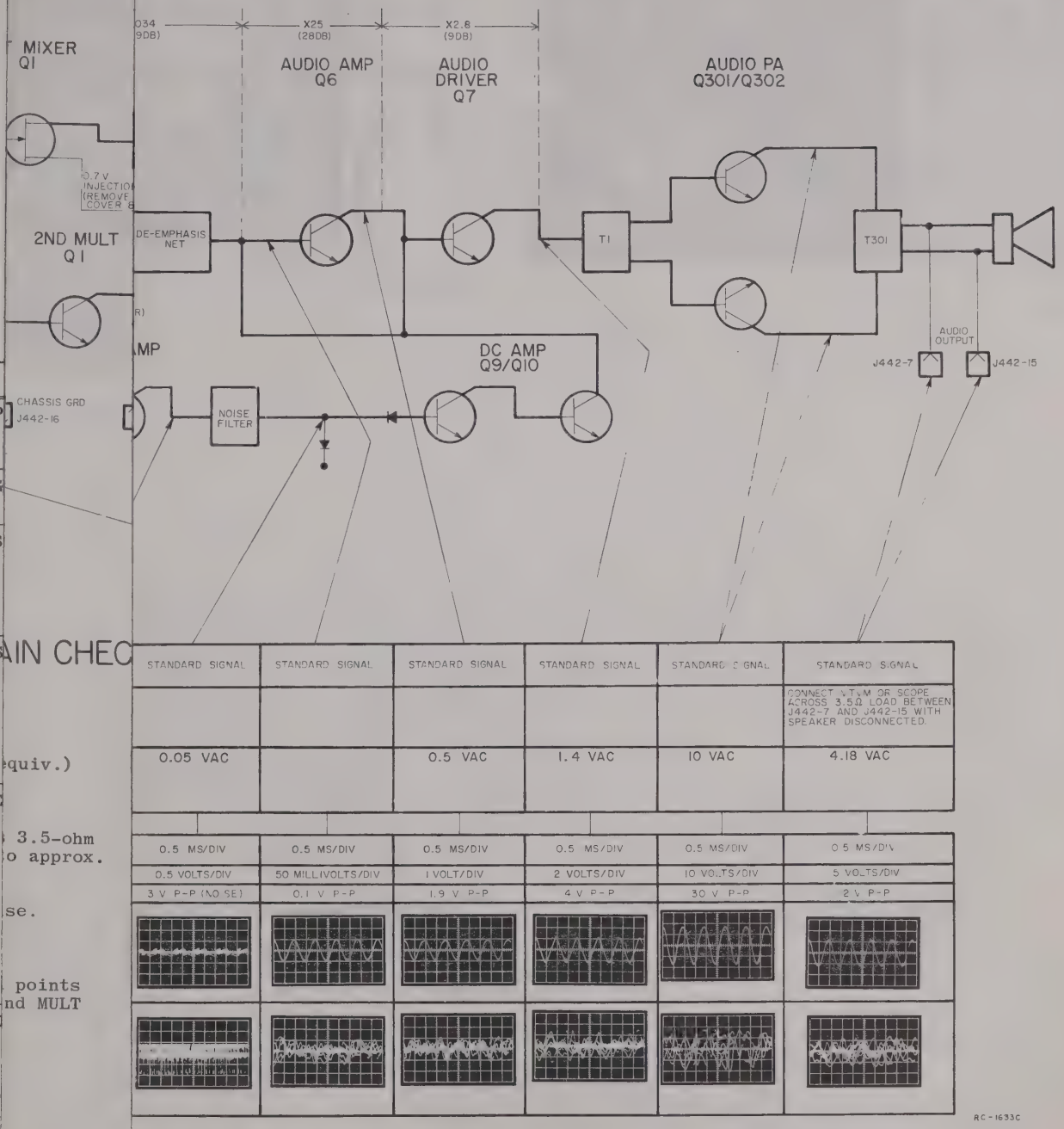
1. GE Test Set Models 4EX3A10, 4EX8K10, or -11, station test meter panel, or 20,000 ohms-per-Volt multimeter.
2. A 450 to 460 mHz source (GE Test Set Model 4EX7A10), and 132-174 MHz signal source. Connect a one-inch piece of insulated wire no larger than .065 inch to generator output probe.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect Test Set to receiver centralized metering jack J442, and set meter sensitivity switch to the TEST 1 or 1-Volt position.
2. For a large change in frequency or a badly mis-aligned receiver, set crystal trimmer C9 on 1st OSC/MULT board (A305-A310 only) to mid-capacity. In multi-frequency receivers set C10, C11 or C12 to mid-capacity as required.
3. In multi-frequency receivers where the maximum frequency spacing is less than 200 kHz, align the unit on channel F1. If the frequency spacing is greater than 200 kHz, align the receiver on the center frequency.
4. With Test Set in position J, check for regulated +10 Volts. If using Multimeter, measure from C312 to C313.
5. If using Multimeter, connect the positive lead to J442-16 (ground).
6. Disable the Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION: GE Test Set or Meter Panel	METERING POSITION: Multimeter - at J442	TUNING CONTROL	METER READING	PROCEDURE
			DISCRIMINATOR		
1.	A (DISC)	Pin 10	L1 and L2 (on IF-AUDIO SQUELCH Board)	Zero	Remove three screws and swing open the IF-AUDIO & Squelch board. Adjust L1 (disc primary) 1/2 turn counterclockwise from the slug bottom. Next, apply a 455-kHz signal to J2 and J4 and adjust L2 (disc secondary) for zero meter reading.
2.	A (DISC)	Pin 10		See Procedure	Alternately apply a 450-kHz and 460-kHz signal at a level of at least 0.3 Volt, but not more than 0.5 Volt rms. Both readings must be within .05 Volt. Do not attempt to set any closer than 0.05 Volt.
			OSCILLATOR, MULTIPLIERS & 1ST MIXER		
3.	D (MULT-1)	Pin 4	L1 (on 1st OSC/MULT) and L1 (on 2nd MULT)	See Procedure	Tune L1 (1st OSC/MULT) for maximum meter reading. Then tune L1 (2nd MULT) for minimum meter reading.
4.	E (MULT-2)	Pin 5	L1 (on 1st OSC/MULT) and L1, L2 and L3 (on 2nd MULT)	See Procedure	Tune L1 (1st OSC/MULT) for L1 and L2 (2nd MULT) for maximum meter reading. Then tune L3 (2nd MULT) for minimum meter reading.
5.	A (MISC)	Pin 10		Zero	Apply an on-frequency signal into Hole 305. Adjust the signal generator for discriminator zero.
6.	B (2nd IF AMP)	Pin 2	L2 and L3 (on 2nd MULT) and C306 (on RF SELECTIVITY)	Maximum	Apply an on-frequency signal as above. Tune L2, L3 and C306 for maximum meter reading, keeping signal below saturation.
7.	B (2nd IF AMP)	Pin 2	L2 and L1 (on 1st MIXER A301-A303)	Maximum	Apply an on-frequency signal into Hole 304, and tune L2 and L1 for maximum meter reading, keeping signal below saturation.
			RF SELECTIVITY		
8.	B (2nd IF AMP)	Pin 2	C305, C304, C303 and C302	Maximum	Apply an on-frequency signal to the Hole shown below, keeping the signal below saturation. Tune C302 through C305 for maximum meter reading as shown below: Insert Generator Probe in: — Tune 1. Hole 304 — C305 2. Hole 303 — C304 3. Hole 302 — C303 4. Hole 301 — C302
			2ND MIXER & HI IF		
The 2nd mixer, and high IF circuits have been aligned at the factory and will normally require no further adjustment. If adjustment is necessary, use the procedure outlined in STEPS 9, 10, and 11. NOTE Refer to DATAFILE BULLETIN 1000-6 IF Alignment of Two-Way Radio FM Receivers for helpful suggestions on how to determine when IF alignment is required.					
9.	B (2nd IF AMP)	Pin 2	L3, L2, L1, T1 (2nd Mixer) and L1 (HI IF AMP)	Maximum	Apply on-frequency, unmodulated signal and tune L3, L2, L1, T1 (2nd mixer) and L1 (HI IF AMP) for maximum meter reading, keeping signal below saturation.
10.			L3, L2, L1, T1 (2nd Mixer) and L1 (HI IF AMP)		Connect scope, signal generator, and detector as shown in Figure 7. Set signal generator level for 30-50 μv and modulate with 10 kHz at 30 Hz. With detector at the collector of Q3 (2nd Mixer board output) tune for double trace as shown on scope pattern.
11.	A (DISC)	Pin 10		See Procedure	Check to see that discriminator idling voltage is within ±.2 Volt of zero with no signal applied. Check to see that modulation acceptance bandwidth is between 2? and 9 kHz.
			FREQUENCY ADJUSTMENT		
12.	A (DISC)	Pin 10	C9 (on 1st OSC/MULT) C10, C11 and C12 for multi-frequency	Zero	Apply an on-frequency signal to the antenna jack. Tune C9 for zero discriminator reading. In multi-frequency units tune C10, C11 or C12 as required. — NOTE — For proper frequency control of the receiver, it is recommended that all frequency adjustments be made with the equipment at a temperature of approximately 75°F. In no case should frequency adjustments be made when the equipment is outside the temperature range of 50° to 90°F.



TROUBLE SHOOTING PROCEDURE

132—174 MHz MASTR RECEIVER
MODELS 4ER41C10-45 & 4ER41E10-45

TEST PROCEDURES

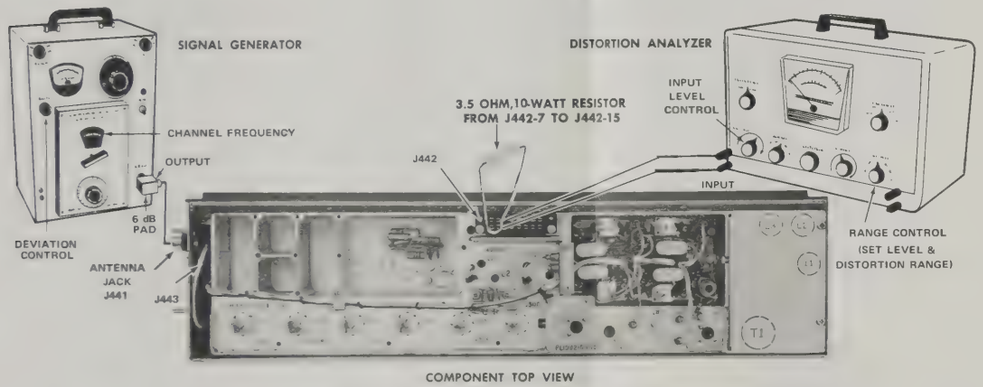
These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

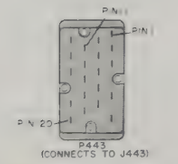
TEST EQUIPMENT REQUIRED

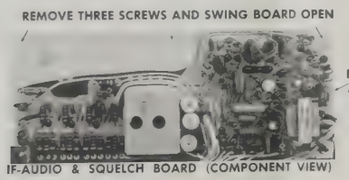
- Distortion Analyzer similar to: Heath IM-12
- Signal Generator similar to: Measurements M-560
- 6-dB attenuation pad, and 3.5-ohm, 10-watt resistor

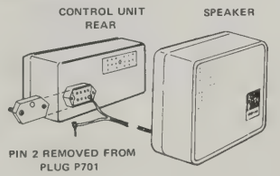
PRELIMINARY ADJUSTMENTS

1. Connect the test equipment to the receiver as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure.
3. Turn on all of the equipment and let it warm up for 20 minutes.









STEP 1
AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Apply a 1,000-microvolt, on-frequency test signal modulated by 1,000 hertz with ±3.0 kHz deviation to antenna jack J441.

B. With Five-Watt Speaker:

Disconnect speaker lead pin from J701-2 (on rear of Control Unit).

Connect a 3.5-ohm load resistor from J442-15 to J442-7. Connect the Distortion Analyzer input across the resistor as shown.

OR

With Handset:

Lift the handset off of the hookswitch. Connect the Distortion Analyzer input from J442-15 to J442-7.

C. Adjust the VOLUME control for five-watt output (4.18 VRMS using the Distortion Analyzer as a VTVM).

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5%. If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than five watts, make the following checks:

E. Battery and regulator voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages.)

F. P.A. Bias Adjust (R43) -- Turn the SQUELCH control fully counterclockwise. Then connect a milliammeter in series with the +12 volt lead at P443-11. With no signal in, adjust R43 for a reading of approximately 20 milliamps. This adjustment should not be necessary unless an output transistor has been replaced.

G. Audio Gain (Refer to Receiver Troubleshooting Procedure).

H. Discriminator Alignment (Refer to Receiver Alignment on reverse side of page).

STEP 2
USABLE SENSITIVITY (12-dB SINAD)

If STEP 1 checks out properly, measure the receiver sensitivity as follows:

A. Apply a 1000-microvolt, on-frequency signal modulated by 1000 Hz with 3.0-kHz deviation to J441.

B. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000-Hz distortion range position (1000-Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)

C. Place the RANGE switch to the SET LEVEL position (filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).

D. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range until a 12-dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

E. The 12-dB difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specification with an audio output of at least 2.5 watts (2.9 volts RMS across the 3.5-ohm receiver load using the Distortion Analyzer as a VTVM).

F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3
MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

If STEPS 1 and 2 check out properly, measure the bandwidth as follows:

A. Set the Signal Generator output for twice the microvolt reading obtained in the 12-dB SINAD measurement.

B. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000-Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

C. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

D. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±7 kHz (but less than ±9 kHz).

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

STEP 1-QUICKCHECKS

TEST SET CHECKS

These checks are typical voltage readings measured with Cl Test Set Model 4EX3A10 in the Test 1 position, or Model 4EX8K10 or 11 in the 1-volt position

Metering Position	Reading with No Signal in	Reading with 1 uV unmodulated signal
A Disc idling	Less than 5.05 VDC	
B 2nd IF	.9v VDC	0.2 VDC
C 1st Lim	0.6 VDC	0.8 VDC
D Mult 1	0.7 VDC	
Mult 2	1 VDC	
J Regulated -10 Volts	10 VDC	

SYMPTOM CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	• Check power connections and continuity of supply leads, and check fuse in power supply. If fuse is blown, check receiver for short circuits.
NO REGULATED 10-VOLTS	• Check the 12-volt supply. Then check regulator circuit (See Troubleshooting Procedure for Power Supply).
LOW 1ST LIM READING	• Check supply voltages and then check oscillator reading at J442-4 & 5 as shown in STEP 2A. • Make SIMPLIFIED VTVM GAIN CHECKS from 2nd Mixer through 1st Limiter stages as shown in STEP 2A.
LOW OSCILLATOR MULTIPLIER READINGS	• Check alignment of Oscillator (Refer to Front End Alignment Procedure). • Check voltage and resistance readings of 1st Oscillator/Multiplier Q1/Q2. • Check crystal Y1.
LOW RECEIVER SENSITIVITY	• Check Front End Alignment (Refer to Receiver Alignment Procedure). • Check antenna connections, cable and relay. • Check 1st and 2nd Oscillator injection voltage. • Check voltage and resistance readings of 1st Mixer, HI IF Amp and 2nd Mixer. • Make SIMPLIFIED GAIN CHECKS (STEP 2A).
LOW AUDIO	• Check Audio PA (Q301 & Q302) voltage readings on schematic diagram. • Make simplified gain and waveform checks of audio and squelch stages (Steps 2A and 2B). • Make unsquelched voltage readings in Audio section (Refer to Receiver Schematic Diagram). • Check voltage and resistance readings on Channel Guard board.
HIGH DISTORTION AT LOW AUDIO LEVELS (50 MW)	• Set PA bias adjust R43 as specified under Service. • Checks in STEP 1 of TEST PROCEDURES.
IMPROPER SQUELCH OPERATION	• Check voltage and resistance readings of Squelch circuit (Refer to Receiver Schematic Diagram). • Make gain and waveform checks of audio and squelch stages (Steps 2A and 2B)
DISCRIMINATOR IDLING TOO FAR OFF ZERO	• See if discriminator zero is in center of IF bandpass.

STEP 3-VOLTAGE RATIO READINGS

EQUIPMENT REQUIRED:

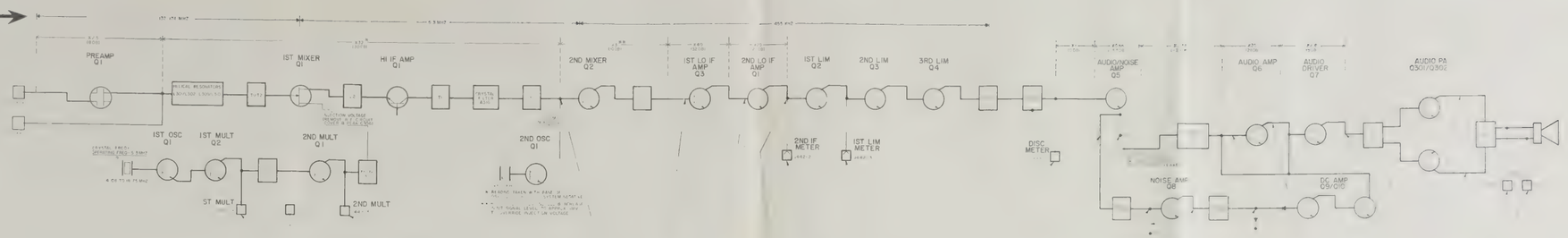
1. RF Voltmeter (Similiar to Boonton Model 91-CA or Millivac Type MV-18 C).
2. Signal on receiver frequency (below saturation). Correct frequency can be determined by zeroing the discriminator. Use 1,000 Hertz signal with 3.3 kHz deviation for audio stage.

PROCEDURE

1. Apply probes to input of stage and system negative (-10 VDC). Take voltage reading (E_1).
2. Move probes to input of following stage and system negative. Take reading (E_2).
3. Convert readings by means of the following formula:

$$\text{Voltage Ratio} = \frac{E_2}{E_1}$$

4. Check results with typical voltage ratios shown on diagram.



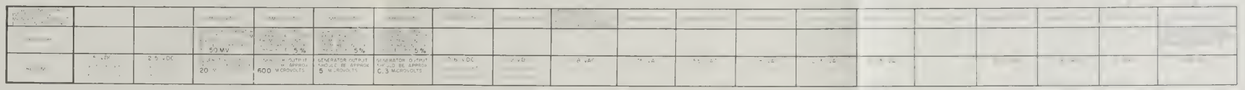
STEP 2A-SIMPLIFIED VTVM GAIN CHECKS

EQUIPMENT REQUIRED:

1. VTVM-AC & DC
2. Signal Generator (measurements M560 or equiv.)

PRELIMINARY STEPS:

1. Set VOLUME control for 4.18 volts across 3.5-ohm load. If this cannot be obtained, set to approx. 70% of max. rotation.
2. Set SQUELCH control fully counterclockwise.
3. Receiver should be properly aligned.
4. Connect VTVM between system negative and points indicated by arrow (except for 1st and 2nd MULT which reference chassis ground).



STEP 2B-AUDIO & SQUELCH WAVEFORMS

EQUIPMENT REQUIRED:

1. Oscilloscope.
2. Signal generator (measurements M560 to equivalent).

PRELIMINARY STEPS:

1. Set VOLUME control for 4.18 volts across 3.5-ohm load. If this cannot be obtained, set to approx. 70% of max. rotation.
2. Set SQUELCH control fully counterclockwise.
3. Receiver should be properly aligned.
4. Connect oscilloscope between system negative and points indicated by arrow.

TONE REJECT FILTER A320 (CONSISTS OF C26 THRU C29, L1 AND R59)

(19C311794, Sh. 1, Rev. 4)
(19C311794, Sh. 2, Rev. 4)

PARTS LIST

LBI-3877L

132-174 MHz RECEIVER
MODELS 4ER41C10-21, 34-45
MODELS 4ER41E10,11, 14-17,20,21
34,35, 38-41,44,45

SYMBOL	GE PART NO.	DESCRIPTION
A301 and A302		FIRST MIXER A301 19B216077G1 132-150.8 MHz A302 19B216077G2 150.8-174 MHz
		- - - - - - - - - CAPACITORS - - - - - - - - -
C4	5494481P11	Ceramic disc: 1000 pf ±20%, 10 XCW; sim to RMC Type JF Discap.
C5*	5494481P112	Ceramic disc: 1000 pf ±10%, 100 DCW; sim to RMC Type JF Discap.
		Earlier than REV A:
	5491189P1	Polyester: .01 µf ±20%, 50 VDCW.
C6*	5490446P2	Variable, ceramic: approx 5 to 25 pf, 350 VDCW, temp coef 0 PPM; sim to Erie Style 557-36. Deleted by REV D.
C7*	7489162P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
		In Models of REV C and earlier:
	5496218P254	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -80 PPM.
C8	5496203P149	Ceramic disc: 220 pf ±10%, 500 VDCW, temp coef -3300 PPM.
C9	5491601P130	Phen: 3.3 pf ±5%, 500 VDCW.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L2*	19B216576G1	Coil.
		In Models of REV C and earlier:
	19A127115G1	Coil.
L3	7488079P6	Choke, RF: 1 µh ±10%, 0.3 ohm DC res max; sim to Jeffers 4411-8K.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A116154P1	N Channel, field effect.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P242J	Composition: 2400 ohms ±5%, 1/4 w.
R2	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R3*	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w. Deleted by REV D.
R4	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R5*	3R77P331K	Composition: 330 ohms ±10%, 1/2 w. Added by REV G.
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T1 and T2		COIL ASSEMBLY T1 19B216100G1 T2 19B216100G2
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496218P235	Ceramic disc: 4.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C2*	5496218P234	Ceramic disc: 3.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
		In REV G and earlier:
	5491238P12	Ceramic disc: 2 pf ±0.25 pf, 500 VDCW, temp coef -80 ±120 PPM.
C3	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B216100P6	Coil.
R6*	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w. Added to G1 by REV H. Added to G2 by REV J.
	5493185P5	Tuning slug.

SYMBOL	GE PART NO.	DESCRIPTION
A303* and A304*		SECOND MULTIPLIER A303 19B219908G1 132-150.8 A304 19B219908G2 150.8-174 (Added to 19E500872G1 by RE (Added to 19E500872G2 by RE
		- - - - - - - - - CAPACITORS - - -
C1	5491601P107	Phenolic: 0.27 pf ±5%, 500 VDCW.
C4	5496203P133	Ceramic disc: 100 pf ±10%, 500 VDC -3300 PPM.
C5	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 V RMC Type JF Discap.
C6	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C7	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 V RMC Type JF Discap.
C8	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C9	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 V RMC Type JF Discap.
C14	5491601P16	Phenolic: 0.62 pf ±10%, 500 VDCW.
C15	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 V RMC Type JF Discap.
C17	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 V RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS
CR1	19A115250P1	Silicon.
		- - - - - - - - - INDUCTORS - - -
L4	19B209420P111	Coil, RF: 0.68 µh ±10%, 0.54 ohms sim to Jeffers 4426-4.
		- - - - - - - - - TRANSISTORS - -
Q1	19A115440P1	Silicon, NPN.
		- - - - - - - - - RESISTORS - - -
R1	3R152P103K	Composition: 10,000 ohms ±10%, 1/4
R2	3R152P104K	Composition: 0.10 megohm ±10%, 1/4
R3	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
		- - - - - - - - - TRANSFORMERS -
T1 and T2		COIL ASSEMBLY T1 19B216097G3 T2 19B216097G4
		- - - - - - - - - CAPACITORS - -
C1	5491601P107	Phenolic: 0.27 pf ±5%, 500 VDCW.
C2	5496218P255	Ceramic disc: 47 pf ±5%, 500 VDCW, -80 PPM.
C3	5496218P252	Ceramic disc: 36 pf ±5%, 500 VDCW, -80 PPM.
C4	5496203P134	Ceramic disc: 100 pf ±5%, 500 VDCW -3300 PPM.
		- - - - - - - - - INDUCTORS - - -
L1	19B216097P6	Coil.
	5491798P5	Tuning slug.
T3 and T4		COIL ASSEMBLY T3 19B216106G3 T4 19B216106G4
		- - - - - - - - - CAPACITORS - -
C9	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 V RMC Type JF Discap.
C10	5496218P241	Ceramic disc: 10 pf ±0.25 pf, 500 coef -80 PPM.
C11	5496218P238	Ceramic disc: 7.0 pf ±0.25 pf, 500 coef -80 PPM.
		- - - - - - - DIODES AND RECTIFIERS
CR1	19A115250P1	Silicon.
		- - - - - - - - - INDUCTORS - - -
L2	19B216106P6	Coil.
	5491798P5	Tuning slug.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

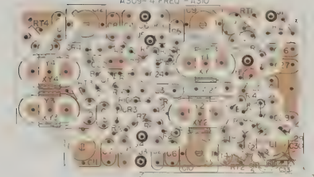
PREAMP (UHS)
A321

(19C320684, Sh. 2, Rev. 1)
(19C320684, Sh. 3, Rev. 21)

1ST OSC/MULT (WITH ICOM)
132-150.8 MHZ 150.8-174 MHZ
A311 - 1 FREQ - A313
A312 - MULTI FREQ - A314

(19D216155, Sh. 1, Rev. 0)
(19D216155, Sh. 2, Rev.)

1ST OSCILLATOR
132-150.8 MHZ 150.8-174 MHZ
A305- 1 FREQ - A306
A307- 2 FREQ - A308
A309- 4 FREQ - A310



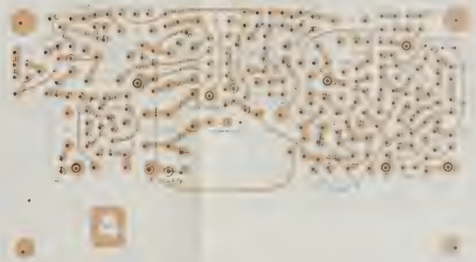
(19D204412, Sh. 1, Rev. 5)
(19D204412, Sh. 2, Rev. 5)

IF-AUDIO & SQUELCH BOARD
A318

(19C311803, Sh. 1, Rev. 4)
(19C311803, Sh. 2, Rev. 6)

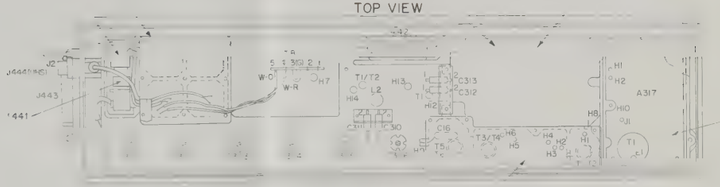
ENCODER-DECODER
A319

TONE REJECT FILTER
A320



(19C311794, Sh. 1, R
(19C311794, Sh. 2, R

TOP VIEW

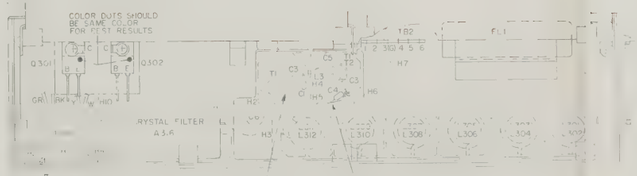


2ND MIXER
A317

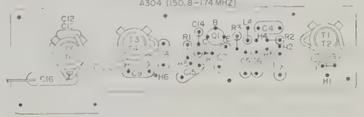
(19D216043, Sh. 1, Rev. 4)
(19D216043, Sh. 2, Rev. 3)

ALTERNATE LINE 4
P.N. NUMBER MARKING ON SIDE OF CAN OR COLOR DOT IDENTIFIES P.N. NUMBER ON DISCRIMINATOR AND 2ND MIXER PCB'S

BOTTOM VIEW



2ND MULTIPLIER
A303 (132-150.8MHZ)
A304 (150.8-174MHZ)



TERMINAL VIEW

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

LEAD IDENTIFICATION FOR
FLAT
IN-LINE
TRIANGULAR
VIEW FROM LEAD END
OR

NOTE LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

(19B521234, Rev 27)

HI IF AMP
A315

1ST MIXER
A301 (132-150.8MHZ)
A302 (150.8-174MHZ)

OUTLINE DIAGRAM

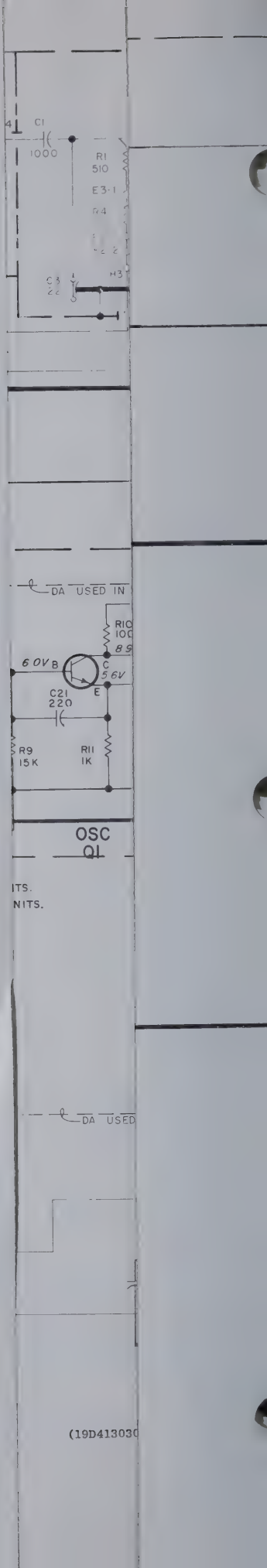
132—174 MHz MASTR RECEIVER
MODELS 4ER41C10-45 & 4ER41E10-45

PARTS LIST

[illegible]

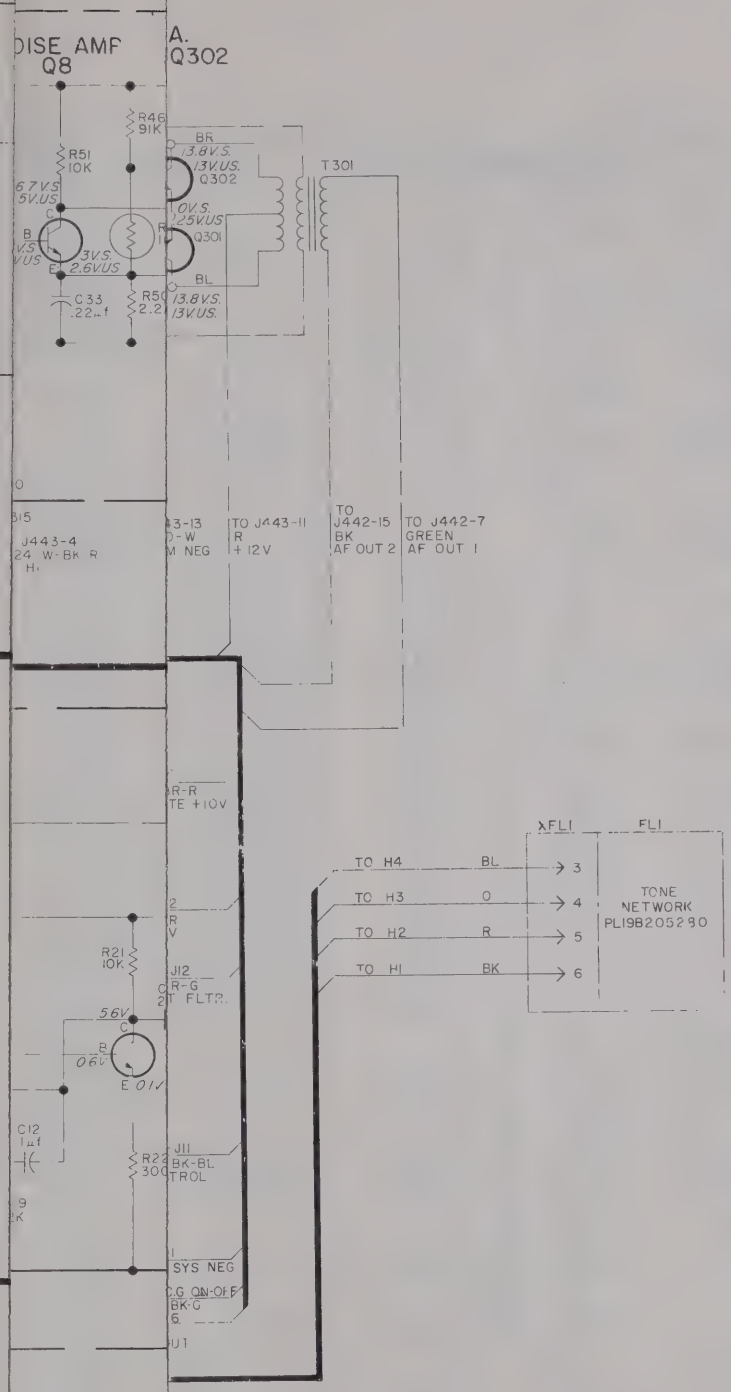
173-174 Mhz RECEIVER
MODELS MR81C(30-32), 34-45
MODELS MR81L(31), 34-37, 39, 45
34-36, 38-41, 46-49

SYMBOL	GE PART NO.	DESCRIPTION
A301-A304, A306*		SECOND MULTIPLIER A301 19B209077G2 133-150.8 MHz A302 19B209077G3 150.8-174 MHz (added to 19E300972G1 to MLP B) Added to 19D300972G2 to MLP P)
[illegible]	[illegible]	[illegible]
C1	54816619107	Phenolic 0.27 pf ±5%, 500 VDCW.
[illegible]	54926039133	Ceramic disc: 100 pf ±10%, 500 VDCW, temp coef +300 PPM.
[illegible]	54844419111	Ceramic disc: 1000 pf ±50%, 1000 VDCW; sim to EMC Type JF Discap.
C6	19A116080105	Polyester. 0.047 pf ±10%, 50 VDCW.
C7	54844419111	Ceramic disc: 1000 pf ±50%, 1000 VDCW; sim to EMC Type JF Discap.
C8	19A116080105	Polyester. 0.047 pf ±10%, 50 VDCW.
C9	54844419111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to EMC Type JF Discap.
C14	54916019106	Phenolic. 0.62 pf ±10%, 500 VDCW.
C15	54844419111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to EMC Type JF Discap.
C17	54844419111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to EMC Type JF Discap.
[illegible]	[illegible]	[illegible]
C21	19A115390P1	Silicon.
C23	54826128239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C24	54826128770	Ceramic disc: 200 pf ±5%, 500 VDCW, temp coef -750 PPM.
L4	19B209430P111	Coil, RF. 0.68 µh ±10%, 0.54 ohm DC res max; sim to Jeffers 4426-4.
[illegible]	[illegible]	[illegible]
Q1	19A115440P1	Silicon, NPN.
[illegible]	[illegible]	[illegible]
R1	3A152903E	Composition: 10,000 ohms ±10%, 1 W.
R2	3A152910E	Composition: 0.10 megohm ±10%, 1 W.
R3	3A152301E	Composition: 100 ohms ±10%, 1/4 W.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]



SCHEMATIC DIAGRAM

132—174 MHz RECEIVER
MODELS 4ER41C10-45 & 4ER41E10-45



IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (J442-8) WITH TEST SET MODEL 4EX3A10 OR A 20,000 OHM-PER-VOLT METER.

S= NO SIGNAL IN WITH SQUELCH CONTROL FULLY COUNTERCLOCKWISE (MAXIUM SQUELCH)

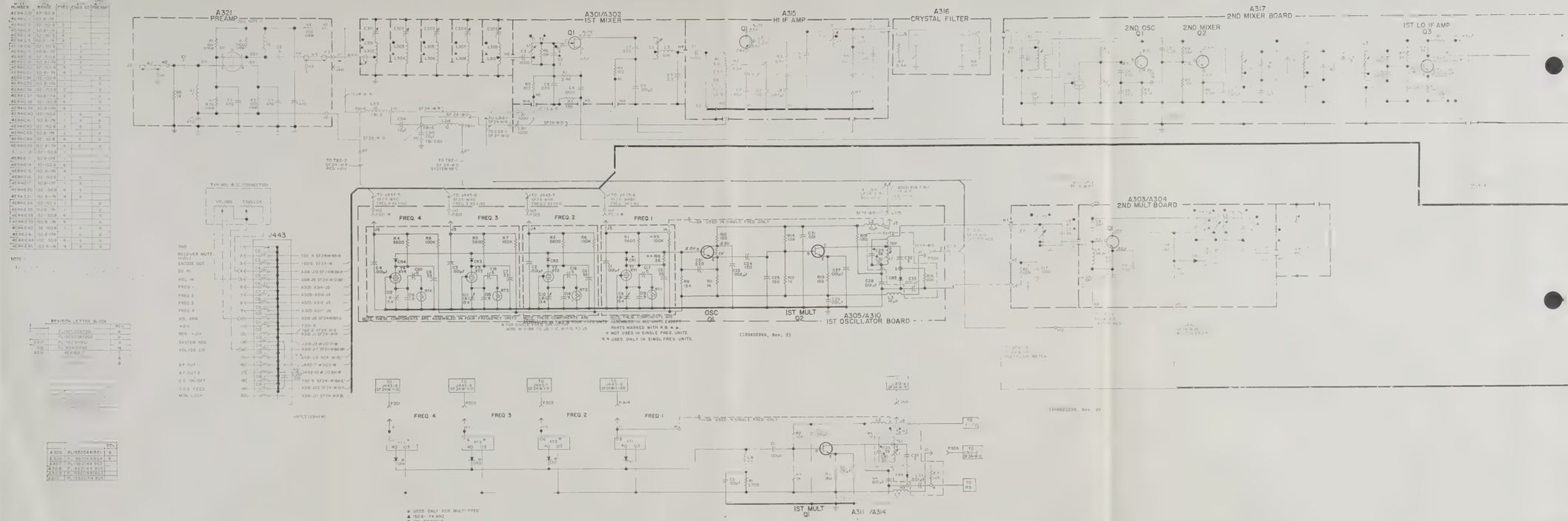
US= SQUELCH CONTROL FULLY CLOCKWISE WITH A ONE MILLIVOLT MODULATED SIGNAL (UNSQUELCHED) AND 5 WATT AUDIO OUTPUT

NOTE: DC VOLTAGES FOR 1ST MIXER, MULTIPLIER, AND 1ST IF AMPLIFIER TAKEN WITH MODULES REMOVED FROM CASTING AND 10 VOLTS APPLIED TO INPUT LEADS.

- ● LOW SPLIT 132-150.8 MHZ
- ▲ HIGH SPLIT 150.8-174 MHZ
- ■ VALUE OF R47 IS DETERMINED BY TEST (SEE TEST SPEC 19A127182)
- ◓ THESE ARE ONLY PARTS PRESENT ON A320
- ✱ ✱ USED IN 4ER41C11 FOR IMTS BASE STATION ONLY

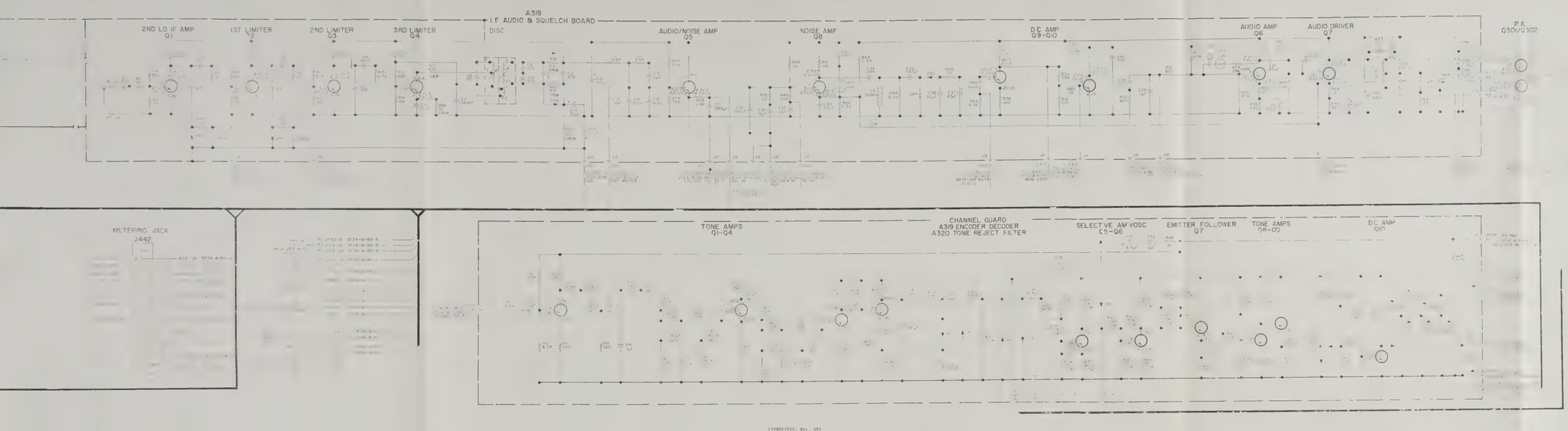
SCHEMATIC DIAGRAM

132—174 MHz RECEIVER
MODELS 4ER41C10-45 & 4ER41E10-45



SCHEMATIC DIAGRAM

132—174 MHz RECEIVER
MODELS 4ER41C10-45 & 4ER41E10-45



(188621220, Rev. 09)

RT NO.	DESCRIPTION
56P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
	- - - - - - - - - - INDUCTORS - - - - - - - - - -
20P101	Coil, RF: 0.10 µh ±10%, 0.08 ohms DC res max; sim to Jeffers 4416-1.
20P103	Coil, RF: 0.15 µh ±10%, 0.10 ohms DC res max; sim to Jeffers 4436-8.
	- - - - - - - - - - TRANSISTORS - - - - - - - - - -
18P1	N Channel, field effect.
	- - - - - - - - - - RESISTORS - - - - - - - - - -
03J	Composition: 10,000 ohms ±5%, 1/4 w.
72J	Composition: 4700 ohms ±5%, 1/4 w.
01J	Composition: 100 ohms ±5%, 1/4 w.
42J	Composition: 2400 ohms ±5%, 1/4 w.
02J	Composition: 1000 ohms ±5%, 1/4 w. Added by REV B.
	- - - - - - - - - - CABLES - - - - - - - - - -
57G1	3 inches long. Includes J2.
56G1	5 inches long. Includes P3.
	RF PRE AMP A321 19A127479G1 132-150.8 MHz A322 19A127479G2 150-8-174 MHz REV A
	- - - - - - - - - - CAPACITORS - - - - - - - - - -
P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
80P101	Polyester: 0.01 µf ±10%, 50 VDCW.
	- - - - - - - - - - TRANSISTORS - - - - - - - - - -
54P1	N Channel, field effect.
	- - - - - - - - - - RESISTORS - - - - - - - - - -
21J	Composition: 220 ohms ±5%, 1/4 w.
20J	Composition: 22 ohms ±5%, 1/4 w.
	- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
	COIL ASSEMBLY T1 19B216479G1 T2 19B216479G2
	- - - - - - - - - - CAPACITORS - - - - - - - - - -
P641	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -470 PPM.
P640	Ceramic disc: 9.0 pf ±0.25 pf, 500 VDCW, temp coef -470 PPM.
	Earlier than REV A:
P638	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -470 PPM.
P5	Tuning slug.
	- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
	COIL ASSEMBLY T3 19B216478G1 T4 19B216478G2
	- - - - - - - - - - CAPACITORS - - - - - - - - - -
P638	Ceramic disc: 7.0 pf ±0.25 pf, 500 VDCW, temp coef -470 PPM.
P635	Ceramic disc: 4.0 pf ±0.25 pf, 500 VDCW, temp coef -470 PPM.
P5	Tuning slug.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	5491689P74	RF. Includes J444 connector.
W2	19B205634G2	RF. Includes J2 connector 19B209122P3.
W3	19A127476G1	RF. Includes P3 connector.
		CHASSIS AND RF CIRCUIT 19E500872G1 LOW SPLIT 19E500872G2 HIGH SPLIT
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C301 thru C306		(See Mechanical Parts RC-1627).
C307	7774750P4	Ceramic disc: .001 µf +100% -0%, 500 VDCW.
C310 thru C313	19B209135P1	Ceramic, feed-thru: 1000 pf +150%-0%, 500 VDCW.
C314	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C315	19A115680P3	Electrolytic: 20 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C317 and C318	5494481P12	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1*	19A116062P2	Selenium. Added by REV C. Deleted in G1 by REV J, deleted in G2 by REV K.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J441		Connector. (Part of W441).
J442	19B205689G2	Connector: 18 contacts.
J443	19C303426G1	Connector: 20 pin contacts.
J444		Connector: (Part of A321/A322-W1).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L301	19B216112G4	Coil.
L302	19B216112G3	Coil.
L303	19B216112G8	Coil.
L304	19B216112G7	Coil.
L305	19B216112G8	Coil.
L306	19B216112G7	Coil.
L307	19B216112G8	Coil.
L308	19B216112G7	Coil.
L309	19B216112G6	Coil.
L310	19B216112G5	Coil.
L311	19B216112G2	Coil.
L312	19B216112G1	Coil.
L313 and L314	7488079P16	Choke, RF: 10 µh ±10%, 0.6 ohm DC res max; sim to Jeffers 4421-7K.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P301 thru P311	4029840P2	Contact, electrical; sim to Amp 42827-2.
P312	4029840P3	Contact, electrical; sim to Amp 42101-2.
P313	4029840P2	Contact, electrical; sim to Amp 42827-2.
P315 thru P317	4029840P2	Contact, electrical; sim to Amp 42827-2.
P319 and P320	4029840P2	Contact, electrical; sim to Amp 42827-2.
P322	4029840P2	Contact, electrical; sim to Amp 42827-2.
P323	4029840P1	Contact, electrical; sim to Amp 41854.

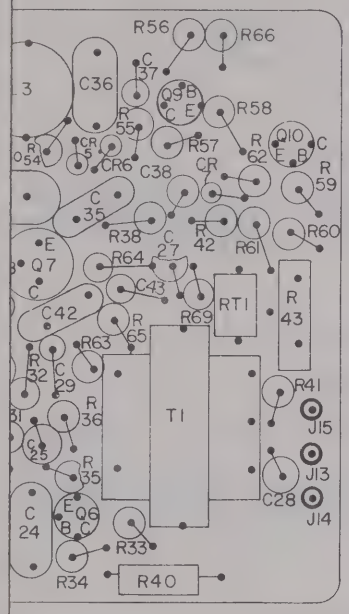
129-G1)

Chang atible with new PA transistors and to improve
"Revi , R75-R79, and RT3. Deleted C24, C28, C29,
the a nged C21, C26, C37, C38, C40, R33, R38, R39,
parts

REV. am Was:

ELCH BOARD
B

REV.



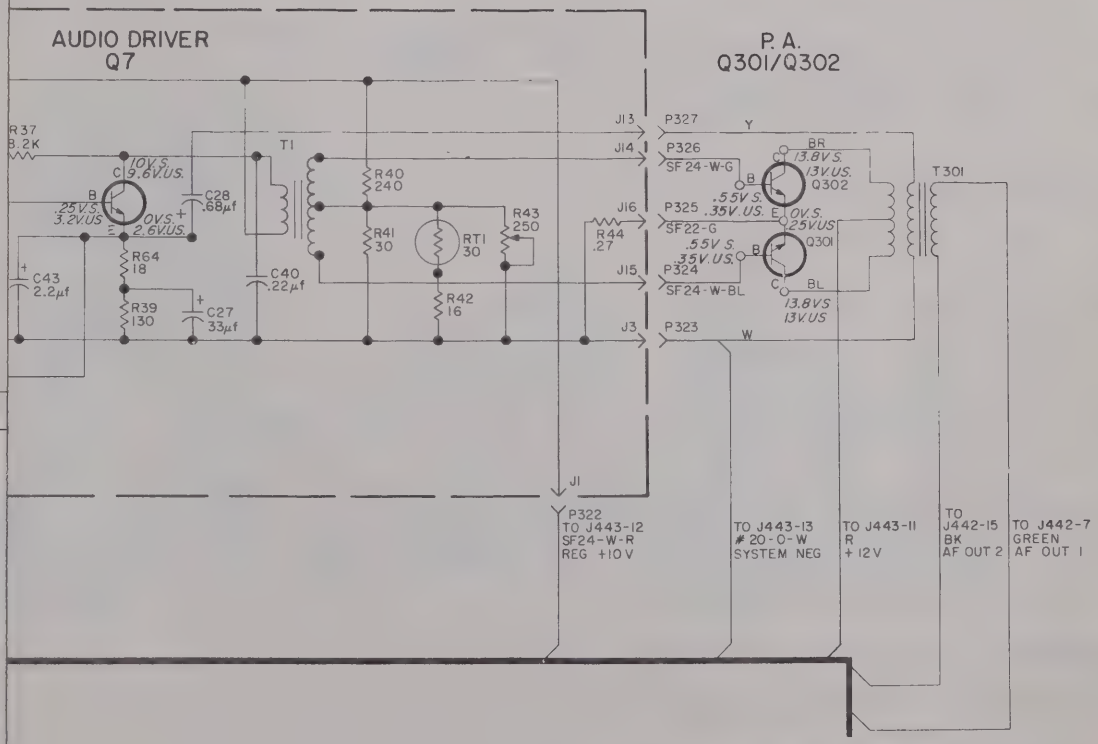
REV.

REV.

REV.

REV.

agram Was:



7.

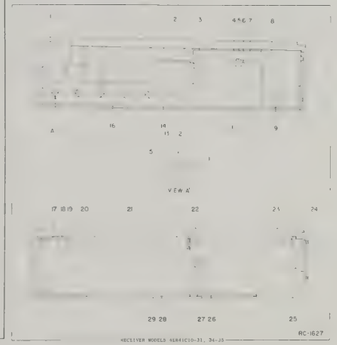
REV.

SYMBOL	GE PART NO	DESCRIPTION
C	19A116[illegible]	Polyester .01 µf ±20% 50 VDCW
C	[illegible]	Polyester .022 µf ±20% 50 VDCW
C	[illegible]	Silver mica .1630 pf ±2% 500 VDCW sim to Electro Motive Type 2K-30.
C	19A116[illegible]	Polyester .047 µf ±20% 50 VDCW
C	[illegible]	Polyester .22 µf ±20% 50 VDCW
		In REV B and earlier.
C	[illegible]	Polyester .1 µf ±20% 50 VDCW
C	[illegible]	Tantalum .47 µf ±20% 15 VDCW sim to Sprague Type 150D
		Earlier than REV A
C	[illegible]	Tantalum 1.0 µf ±20% 15 VDCW sim to Sprague Type 150D
C	[illegible]	Tantalum .22 µf ±20% 15 VDCW sim to Sprague Type 150D. Deleted by REV C
		Earlier than REV A
C	[illegible]	Tantalum .15 µf ±20% 20 VDCW sim to Sprague Type 150D.
C	[illegible]	Polyester .01 µf ±20% 50 VDCW
C	[illegible]	Tantalum .068 µf ±20% 35 VDCW sim to Sprague Type 150D
		In REV A and earlier
C	[illegible]	Tantalum .47 µf ±20% 35 VDCW sim to Sprague Type 150D
		Earlier than REV A
C	[illegible]	Polyester .22 µf ±10% 50 VDCW
C	[illegible]	Silver mica .120 pf ±10% 500 VDCW sim to Electro Motive Type 2K-15.
C	[illegible]	Polyester .033 µf ±20% 50 VDCW. Deleted by REV A
C	[illegible]	Tantalum 2.2 µf ±10% 20 VDCW sim to Sprague Type 150D. Added by REV A
C	[illegible]	Tantalum 3.3 µf ±10% 20VDCW sim to Sprague Type 150D added by REV A. Deleted by REV C
C	[illegible]	Polyester 0.1 µf ±20% 50 VDCW Added by REV A
C	[illegible]	Ceramic disc 2700 pf ±10% 1000 VDCW sim to RMC Type JF Disktap. Added by REV A
C	[illegible]	Polyester 0.22 µf ±10% 50 VDCW Added by REV A
C	[illegible]	Tantalum 2.2 µf ±10% 20 VDCW sim to Sprague Type 150D Added by REV A
C	[illegible]	Tantalum 15 µf ±20% 20 VDCW sim to Sprague Type 150D Added by REV C
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR	[illegible]	Silicon.
CR	[illegible]	Silicon
		In REV F and earlier
		Germanium
CR	[illegible]	Silicon
CR	[illegible]	Silicon. Deleted by REV C
CR	[illegible]	Silicon. Added by REV A. Deleted by REV C
CR	[illegible]	Silicon. Added by REV A. Deleted by REV C
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J	[illegible]	Contact, electrical sim to Bead Chain L83-3
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L	[illegible]	Transformer freq 455 KHz sim to TOKO PETCH-[illegible]
L	[illegible]	Transformer freq 455 KHz sim to TOKO PETCH-[illegible]
L	[illegible]	Choke. Includes tuning slug 744A322P7

SYMBOL	GE PART NO	DESCRIPTION
	[illegible]	[illegible]
	[illegible]	[illegible]
	[illegible]	[illegible]
C	[illegible]	[illegible]
C	[illegible]	[illegible]
C

SYMBOL	GE PART NO.	DESCRIPTION
J443	[illegible]	Contact, electrical. sim to Amp 42827-2.
J444		
J445		
J447	4029840P2	Contact, electrical. sim to Amp 41454.
Q301, Q302	19A116741P1	Silicon, NPN.
Q303		
		In 19E500872G1 REV A-L. In 19E500872G2 REV E-R:
	19A116203P2	Silicon, NPN
		In REV D and earlier:
	19A115946P1	Silicon, NPN.
R1	[illegible]	- - - - - - - - - - RESISTORS - - - - - - - - - -
		Composition 330 ohms ±10%, [illegible] REV G
R302	19A116378P444	Metal film: 0.28 megohm ±2%, 1 2 w.
R303	387AP390E	Composition. 39 ohms ±10%, 1 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T301	19A116041P2	Audio freq 300 to 4000 Hz. Pri 1.00 ohms ±15% DC res. Sec 1 23 ohms ±10% DC res. Sec 2 10.5 ohms ±15% DC res
		- - - - - - - - - - TERMINAL BOARDS - - - - - - - - - -
TB1	7487424P7	Miniature, phen 4 terminals.
TB2	7487424P26	Miniature, phen: 6 terminals.
		- - - - - - - - - - CABLES - - - - - - - - - -
W441	[illegible]	Coaxial approx 5 inches long. Includes J441.
		HARNESS ASSEMBLY 19E500872G1 (Includes C307, C317, C319, J442, J443, P301-P304, P307-P313, P315-P317, P319, P320, P322-P327, R302, R303, T301, TB2)
		CHANNEL GUARD MODIFICATION KIT 19A127175G1 (Used with A319)
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	[illegible]	Harness (Encoder Decoder). Includes
P441	4029840P2	Contact, electrical: sim to Amp 42827-2
P443	4029840P2	Contact, electrical: sim to Amp 4282 [illegible]
P444	4029840P2	Contact, electrical: sim to Amp 42827-2
P445, P446	[illegible]	Contact, electrical. sim to Amp 42827-2.
P447		
		CHANNEL GUARD MODIFICATION KIT 19A127176G2 (Used with A320)
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	[illegible]	Harness (Tone Reject Filter). Includes
P321	4029840P2	Contact, electrical. sim to Amp [illegible]
P322	4029840P2	Contact, electrical: sim to Amp [illegible]
P323, P324	[illegible]	Contact, electrical. sim to Amp [illegible]
		MECHANICAL PARTS (SEE MC-1627)
	19C303386G4	Bottom cover. (Station)
	19C303386G5	Bottom cover (Mobile)
	19C117344P1	Heat sink.

SYMBOL	GE PART NO.	DESCRIPTION
[illegible]	19A121322P1	Support. (Mounts C312 and C313).
[illegible]	4033049P1	Clip. (Part of XY1-XY4).
5	19B209525P9	Rivet. (Part of XY1-XY4).
[illegible]	19A115793P1	Contact. (Part of XY1-XY4).
[illegible]	4039307P1	Crystal socket. (Part of XY1-XY4).
[illegible]	19B216013P1	Cover. (Used with A317).
9	4034353P5	Can. (Used with T1 on A317).
[illegible]	19C303369G1	Chassis.
[illegible]	4039765G2	(Not Used).
12	4036765G4	Screw. (Part of C301 thru C306).
[illegible]	7137968P8	Nut, stamped: No. 6-32 thread. sim to Palnut [illegible] (Part of C301 thru C306).
[illegible]	19A121221P1	Support. (Mounts C310 and C311).
[illegible]	4036989P4	(Not Used).
16	7145451P1	Cleat.
17	19B204543G2	Hinge.
[illegible]	19B216727P1	Support. (Used with Q301 and Q303).
[illegible]	19A116023P2	Plate, insulated. (Used with Q301 and Q303).
[illegible]	19A116032P1	Insulator, bushing. (Used with Q301 and Q303).
[illegible]	4029851P6	Clip, loop: nylon. sim to Weckesser 5/16-4-128.
[illegible]	19B204583G1	Hinge.
[illegible]	19B204583G3	Hinge.
[illegible]	19A121676P1	Guide pin.
[illegible]	19C303495G3	Top cover. (Station, except Repeaters and VW).
[illegible]	19C303676G3	Top cover. (Station, Repeator and VW only).
[illegible]	19C303365P2	Top cover. (Mobile).
[illegible]	19A121297P1	Angle.
[illegible]	2160861P4	Nut, sheet spring: sim to Tinnerman C6452-82-157. (Used to secure cover).
[illegible]	4035267P2	Button, plug. (Used with A318 thru A320).
[illegible]	4033655P1	Insulator, washer: nylon. (Used with Q7 on A318).



RECEIVER MODELS 4ER41C10-31, 34-35

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the number of the assembly. The revision stamped on the assembly includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Chassis and RF Assembly 19E500872-G1 & -G2

To incorporate a better high-frequency capacitor. Changed C5 on First Mixer A301/A302.

REV. A - 2nd Mixer A317 (19B216119-G1)

To make receiver compatible with new system. Added C17.

REV. B - Chassis and RF Assembly 19E500872-G1 & -G2

To improve stability. Changed C2 on Hi IF Amp A315.

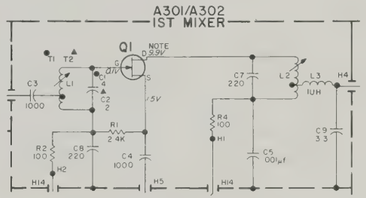
REV. C - Chassis and RF Assembly 19E500872-G1 & -G2

To protect the receiver against positive voltage transients. Added thyrector CR1 between J443-11 and -13.

REV. D - Chassis and RF Assembly 19E500872-G1 & -G2

To improve sensitivity and improve Intermodulation (EIA) performance. Deleted C6 & R3 and changed C7 & L2 on First Mixer A301/A302.

Schematic Diagram Was:



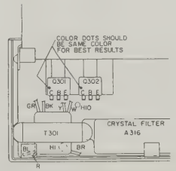
Step 7 of receiver alignment was:

7.	B (2nd IF AMP)	Pin 2	C6 and L1 (on 1st MIXER A301/A302)	Maximum	Apply an on-frequency signal into Hole 304, and tune C6 and L1 for maximum meter reading, keeping signal below saturation.

REV. E - Chassis and RF Assembly 19E500872-G1 & -G2

To incorporate new PA transistors. Changed Q301/Q302 and added R303.

Outline Diagram Was:



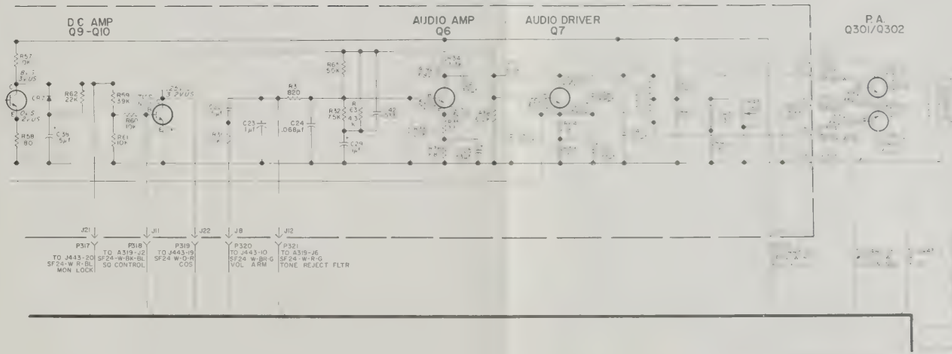
REV. A - IF Audio & Squelch Board A318 (19D413129-G1)

To make IF Audio & Squelch Board compatible with new PA transistors and to improve squelch operation. Added C49-C54, CR8, R75-R79, and RT3. Deleted C24, C28, C29, C42, C43, R32, R37, R63 and R65. Changed C21, C26, C37, C38, C40, R33, R38, R39, R41, R42, R48, R53 and R62.

Outline Diagram Was:

IF-AUDIO & SQUELCH BOARD
A318

Schematic Diagram Was:



NG	PROCEDURE
ım	Apply an on-frequency signal to the antenna jack. On UHS receivers, tune T1/T2 and T3/T4 (PREAMP) for maximum meter reading. On all receivers, tune C301 through C306 for maximum meter reading, keeping signal below saturation. Then retune C301 through C306 slightly for maximum quieting.
ım	Apply an on-frequency signal to the antenna jack. On UHS receivers, tune T1/T2 and T3/T4 (PREAMP) for maximum meter reading. On all receivers, tune C301 through C306 for maximum quieting.

348 (19D413129-G1

Changed R80.

nse. Changed C26.

anged Q5.

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

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Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

PRODUCTION CHANGES

REV. B - Channel Guard Encoder/Decoder A319 (Model 4EK16A10)

To increase stop-band attenuation. Changed R8.

REV. C - Channel Guard Encoder/Decoder A319 (Model 4EK16A10)
REV. A - Tone Reject Filter A320 (19C311797-G2)

To optimize frequency response. Changed C29.

REV. F - Chassis and RF Assembly (19E500872-G1 & G2)

To eliminate squelch opening thump in receivers with Channel Guard. Removed White-Orange wire between J443-13 and TB2-1. Added a White-Orange wire between P312 (or J17 on IF Audio and Squelch board) and TB2-1.

REV. A - RF Pre Amp A322 (19A127479-G2)

To assure band-end tuning at 150.8 MHz. Changed C2.

IF Audio & Squelch Board A318 (19D413129-G1)

REV. B - To control more closely the squelch control rotation. Changed R48.

REV. C - To eliminate barely audible squelch switching transients and to reduce receiver squelch tail. Deleted C38, C49, CR7, CR8, R62, R75, and R76. Added C55, R80, R81, and R82. Changed C27, C36, R53, R64, and R77.

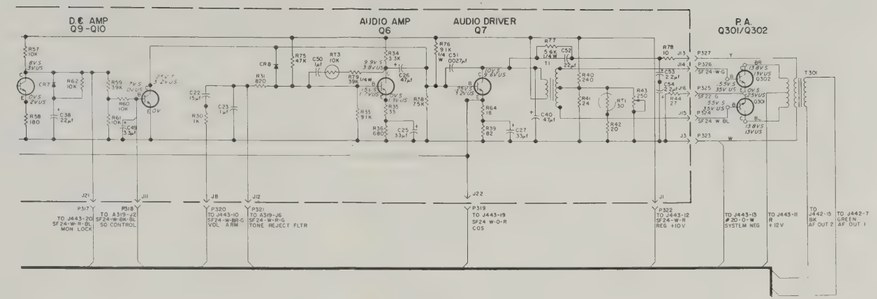
Outline Diagram was:

IF-AUDIO & SQUELCH BOARD
A318

PRODUCTION CHANGES

132—174 MHz MASTR RECEIVER
MODELS 4ER41C10-45 & 4ER41E10-45

Schematic Diagram Was:



REV. D - IF Audio & Squelch Board A318 (19D413129-G1)

To improve receiver frequency response. Changed R30 and R78.

REV. D - Channel Guard Encoder/Decoder A319 (Model 4EK16A10)
REV. B - Tone Reject Filter A320 (19C311797-G2)

To prevent excessive roll-off at 300 Hertz. Changed R59.

REV. E - IF Audio & Squelch Board A318 (19D413129-G1)

To compensate for vendor change. Changed C26.

REV. F - IF Audio & Squelch Board A318 (19D413129-G1

To improve squelch action. Changed R53.

REV. G - Chassis and RF Assembly (19E500872-G1 & G2)

To stabilize the 1st mixer. Deleted R301 on the 2nd Multiplier and added R5 to the 1st mixer.

REV. H - Chassis and RF Assembly (19E500872-G2)

To improve tuning of the 1st mixer. Changed C2.

REV. H - Chassis and RF Assembly (19E500872-G1)

To eliminate oscillations. Added R6.

REV. J - Chassis and RF Assembly (19E500872-G2)

To eliminate oscillations. Added R6.

REV. J - Chassis and RF Assembly (19E500872-G1)

To remove unnecessary protection. Removed CR1.

REV. K - Chassis and RF Assembly (19E500872-G2)

To remove unnecessary protection. Removed CR1.

REV. H - IF Audio and Squelch Board A318 (19D413129-G1)

To insure squelch action at -30°C. Changed Q10.

REV. K - Chassis and RF Assembly (19E500872-G1)

To eliminate oscillation in Hi IF Amplifier. Added L2 and Ferrite Bead.

REV. L - Chassis and RF Assembly (19E500872-G2)

To eliminate oscillation in Hi IF Amplifier. Added L2 and Ferrite Bead.

REV. L - Chassis and RF Assembly (19E500872-G1)

To increase injection from multiplier chain. Deleted R1 and R2. Changed Q1 and R3. Added L4.

REV. M - Chassis and RF Assembly (19E500872-G2)

To increase injection from multiplier chain. Deleted R1 and R2. Changed Q1 and R3. Added L4.

REV. M - Chassis and RF Assembly (19E500872-G1)

To incorporate a new transistor. Changed Q301 & Q302.

REV. N - To improve design
Changed Q1.

REV. N - Chassis and RF Assembly (19E500872-G2)

To incorporate a new transistor. Changed Q301 & Q302.

REV. P - To improve design
Changed Q1.

REV. J - IF Audio and Squelch Board A318 (19D413129-G1)
To improve PA bias.
Changed R40

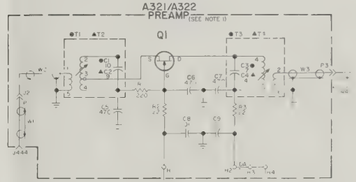
REV. K - To improve stability of audio output with no load.
Added R85

REV. L - To improve frequency response
Deleted R85 and changed C40.

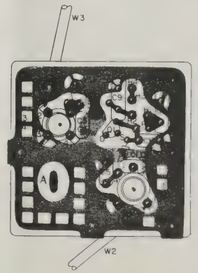
REV. A - RF Pre Amp A321 (19A127479-G1)

To incorporate improved design
Changed UHS Pre Amp Board.

Schematic Diagram was:



Outline Diagram Was:



Alignment Procedure Was

METERING POSITION				
CE Test Set or Meter Panel	Multimeter + 1) J42	TUNING CONTROL	METER READING	PROCEDURE
8 (2nd IF AMP)	Pin 2	C301, C302, C303, C304, C305 and C306 (on all receivers) and T1-T2 & T3-T4 (UHS receivers)	Maximum	Apply an on-frequency signal to the antenna input connector. Adjust T1-T2 and T3-T4 (PREAMP) for maximum meter [illegible] Then adjust C301 through C306 for maximum meter reading. Repeat adjustments. Then readjust C301 through C306 slightly for maximum quieting.
8 (2nd IF AMP)	Pin 2	C301, C302, C303, C304, C305 and C306 (on all receivers) and T1-T2 & T3-T4 (UHS Receivers)	Maximum	Apply an on-frequency signal to the antenna input connector. Adjust T1-T2 and T3-T4 (PREAMP) for maximum meter reading. Then readjust C301 through C306 for maximum quieting.

REV. M - IF Audio & Squelch Board A348 (19D413129-G1

To improve audio quality. Changed R80.

REV. N - To improve frequency response. Changed C26.

REV. P - To improve stability . Changed Q5.

ORDERING SERVICE PARTS

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MAINTENANCE MANUAL

LBI-3867

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

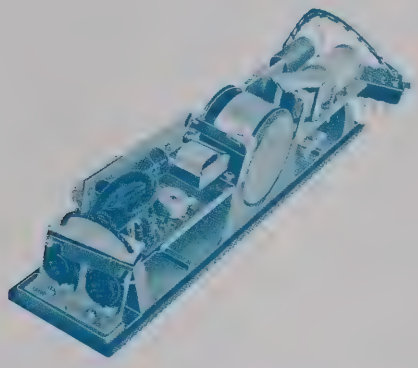
GENERAL ELECTRIC

PRINTED IN U.S.A.

MOBILE RADIO

MASTR Progress Line

12-VOLT, 70/90/100-WATT POWER SUPPLY MODEL 4EP37A10



Maintenance Manual LBI-3504K

EP-37-A

SPECIFICATIONS *

Type Number	EP-37-A	
Output	Voltage	Current
Regulated Receiver	10 volts	150 mA
Regulated Transmitter		
25 — 88 MHz	-20 volts	45 mA
132 — 470 MHz	-20 volts	90 mA
Bias	-45 volts	
Low B-Plus		
25 — 88 MHz	300 volts	70 mA
132 — 174 MHz	300 volts	110 mA
406 — 470 MHz	300 volts	95 mA
High B-Plus		
25 — 88 MHz	660 volts	280 mA
132 — 174 MHz	680 volts	220 mA
406 — 470 MHz	660 volts	270 mA
Battery Drain		
Transmit		
25 — 88 MHz	13.4 volts	25 amps
132 — 174 MHz	13.4 volts	26 amps
406 — 470 MHz	13.4 volts	26 amps
Receive		
Standby - Squelched	13.8 volts	150 mA
Standby - Unsquelched	13.8 volts	1.1 amps
Squelched - Transmitter Filaments On	13.8 volts	1.75 amps (25 — 88 MHz) 1.9 amps (132 — 174 MHz) 2.2 amps (406 — 470 MHz)
Transistors		
Multivibrator Circuit	4	
10-Volt Regulator Circuit	3	
-20 Volt Regulator Circuit	2	
Rectifiers	10	
Zener Diodes	2	
Battery Voltage	13.4 volts ±20% (positive or negative ground, 12-volt system)	
Duty Cycle	Transmit: 20% (one minute transmit, four minutes off)	
Ambient Temperature Range	-30°C (-22°F) to +60°C (+140°F)	

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

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Figure 4 Multiplier and PA B-Plus Circuits 4

Figure 5 -20 Volt Regulator Circuit 4

Figure 6 Disassembly of Power Supply 5

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

Transistorized Power Supply Model 4EP37A10 is used with 12-volt, 70-Watt, 90-watt and 100-watt MASTR mobile combinations. The power supply provides:

- Plate, screen and bias voltages for the tubed transmitter multiplier and power-amplifier stages.
- Regulated -20 volts for the transistorized transmitter exciter board.
- Regulated +10 volts for the receiver and for the transmitter Channel Guard board.

Low voltage for the transmitter filaments and receiver audio amplifier is taken directly from the vehicle battery.

The fully transistorized power supply uses highly efficient silicon rectifiers for reliable operation. The use of Mylar® capacitors provides additional reliability, with good performance at low temperatures. Regulation of critical transmitter and receiver supply voltages provides improved operation over the wide range of input voltages encountered in mobile communications.

CIRCUIT ANALYSIS

The power supply may be used in vehicles having either positive or negative ground systems. The power cable, fused leads and ground wire must be connected for the proper polarity when the Two-Way Radio is installed.

All connections to the transmitter, receiver and power cables are made through two plug connectors. Two clip-on connectors (P501 and P502) connect the power supply to the push-to-talk relay on the system frame. Figure 2 is a simplified power distribution and switching diagram.

MULTIVIBRATOR CIRCUIT (Figure 1)

Power Supply Model 4EP37A10 uses transistors as switches in two identical inductively coupled multivibrator circuits. These switches connect the battery voltage across alternate halves of the transformer primary-resulting in alternating square waves. The output of each multivibrator circuit (square wave generator) is stepped up by the power transformer; then rectified and filtered to supply B-plus and bias voltages for the transmitter.

The two identical multivibrator circuits operate in parallel pairs (Q501-Q503 and Q502-Q504). Separate bias parallel windings are used to provide equal load sharing between the paired transistors. Since both multivibrators operate in the same manner, a description of the operation of Q501 and Q502 only will be given.

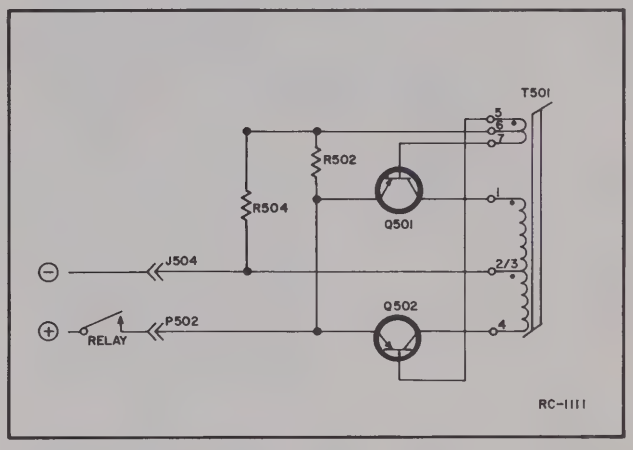


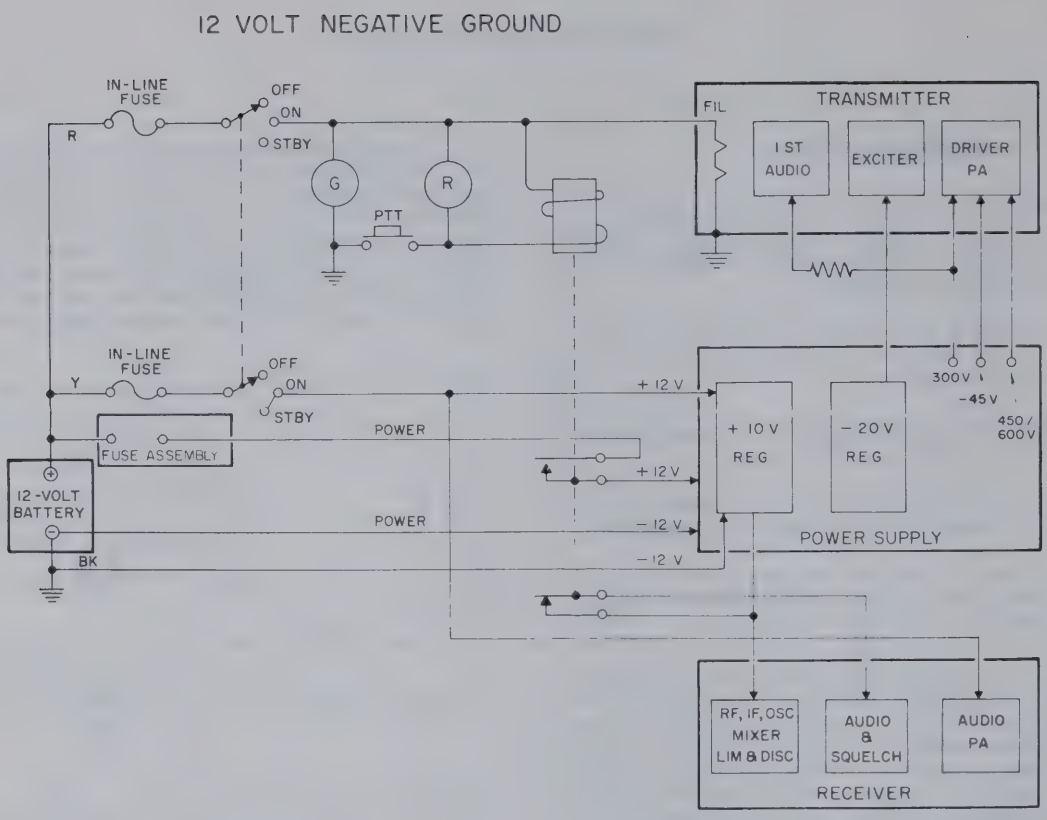
Figure 1 - Simplified Multivibrator Circuit

Keying the transmitter closes the relay contacts and applies power to transistors Q501 and Q502. The bases of the transistors are biased negatively (with respect to their emitters) through resistor R504, and all transistors start to conduct. Due to inherently different characteristics, one transistor will conduct slightly more than the others.

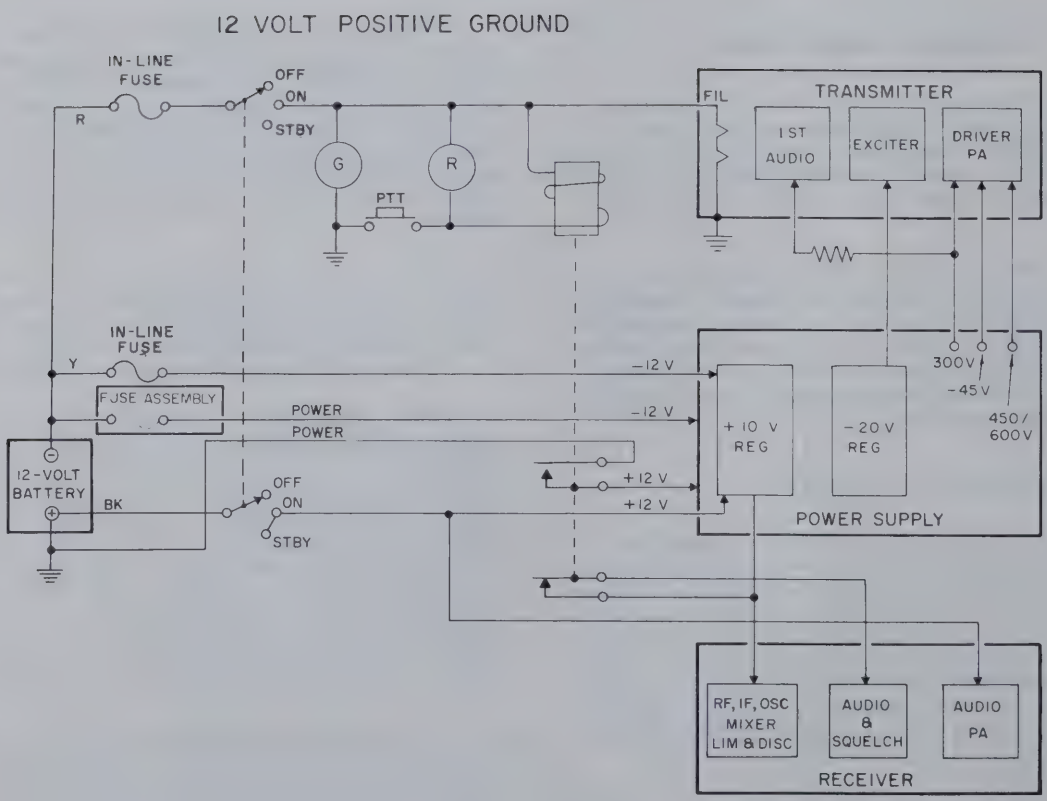
Assuming that Q501 will initially conduct more than Q502, Q501 will draw more current through winding 1-2/3 than Q502 will draw through winding 2/3-4, making terminal 1 of T501 more positive than terminal 4.

The increasing magnetic field in the core of T501 induces a voltage in the windings 5-6-7, causing terminal 7 to become negative with respect to the emitter of Q501. This increased bias causes Q501 to conduct even harder. At the same time, terminal 5 becomes positive with respect to the emitter Q502, stopping current flow through Q502 and winding 2/3-4. Current through winding 1-2/3 rapidly saturates the core of the transformer, and the magnetic field ceases to increase.

The voltage induced in winding 5-6-7 therefore falls to zero, reducing the bias on Q501 to that obtained through R504. This reduced bias tends to cut off Q501 and



RC-1168A



RC-1169A

Figure 2 - 12-Volt Power Distribution Diagram

reduce the current through winding 1-2/3.

The collapsing magnetic field in T501 induces a reverse biasing voltage across winding 5-6-7, biasing Q501 off and biasing Q502 on. Q502 now conducts in a similar manner until T501 is again saturated. Resistor R502 limits the base current which can flow through Q501 and Q502.

The two transistor pairs continue to conduct alternately at a frequency of approximately 1330 hertz. The resulting waveform approaches that of a perfect square wave.

RECTIFIER AND FILTER CIRCUITS

Negative Bias and -20 Volt Regulator (Figure 3) - The AC voltage developed across secondary windings 12-8-14 of transformer T501 is rectified by full-wave rectifiers CR501 and CR502, and is filtered by C501, L502 and C502. The negative 45 volts is the bias voltage for the control grids of the transmitter driver and power amplifier. This circuit also supplies -45 volts to input of the 20-Volt Regulator. The bias voltage is present as a protective measure to limit cathode current in the PA tube while the PA is untuned, or in case of loss of drive to the PA.

Transmitter Multiplier B-Plus (Figure 4) - The AC voltage developed across high voltage secondary windings 18-21 of T501 is rectified by using a bridge rectifier circuit consisting of CR503, CR504, CR505 and CR506. Filtering is provided by filter C505, L501 and C506. Relatively small values of L and C are required because of the high frequency and the square wave characteristics of the AC voltage.

Power Amplifier B-Plus (Figure 4) - The AC voltage developed across the high voltage secondary windings 15-17 of T501 is rectified by the bridge rectifier circuit. CR507, CR508, CR509 and CR510. The output of this bridge rectifier circuit is connected in series with the multiplier B-plus bridge circuit to provide the high B-plus output. Filtering is provided by C507. R510 and R511 are bleeder resistors for discharging C507 when the keying relay is opened. R505 prevents ringing in the oscillator circuit formed by C505, L501 and C506.

-20 VOLT REGULATOR (Figure 5)

The -20 Volt Regulator provides a closely controlled supply voltage for the transistorized exciter section of the transmitter. Input power is taken from the -45 volt bias output at TB1-3. Dropping resistor R507 provides the negative bias to turn on Q506. Zener diode VR501 provides a voltage reference for the regulator.

When the input voltage at TB1-3 rises, the output voltage at the emitter of Q506 also tends to rise. This causes a change in the base-emitter bias on Q507, making it conduct more heavily. When Q507 conducts, there is less base bias on Q506, and less base current. With less current, the voltage drop across Q506 is larger; and the output voltage remains constant.

When the input voltage starts to drop, the output voltage also tends to drop; and Q507 will conduct less. This increases the forward bias on Q506 and reduces the voltage drop across the transistor so that the output voltage remains constant.

Capacitor C511 prevents high frequency oscillation.

R506, R508 and R512 form an adjustable voltage divider so that potentiometer R508 can be adjusted for a -20 volt output. R509 provides bias current for VR501. The output is metered at the transmitter centralized metering jack J102-12.

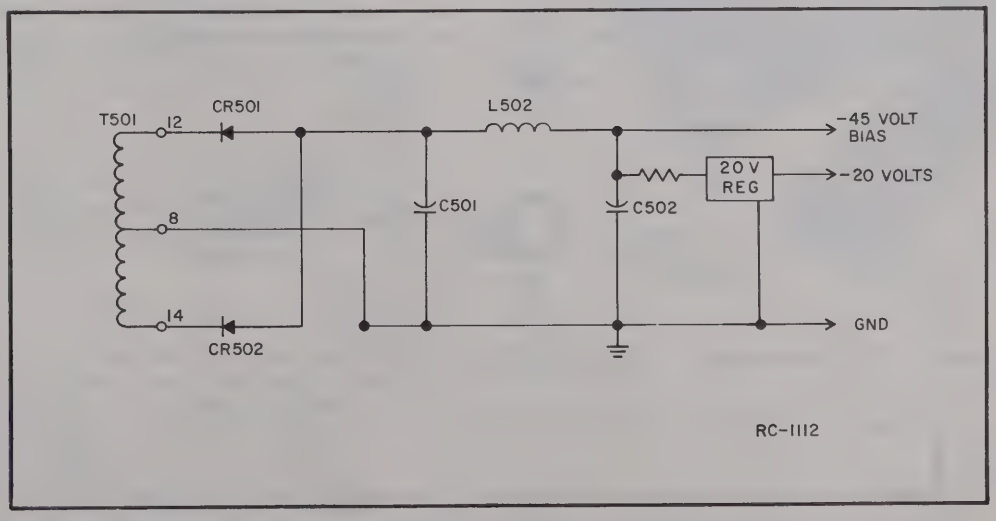


Figure 3 - Simplified Bias and -20 Volt Regulator Supply Circuit

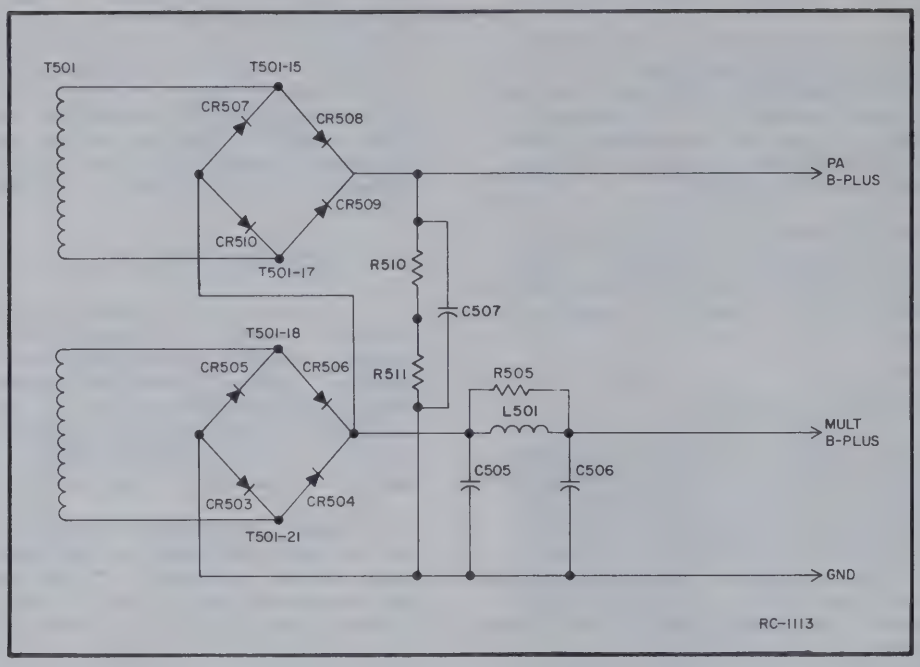


Figure 4 - Simplified Transmitter Multiplier and Power Amplifier B-Plus Circuits

10-VOLT REGULATOR A501

The 10-Volt Regulator Circuit provides a closely controlled supply voltage for the receiver (except for the audio amplifier), and a supply voltage for the transmitter Channel Guard option, when present. Input voltage is supplied from the Control Unit on P505-5.

When the supply voltage (or output) starts to increase, the voltage at the base of Q1 also increases. As the emitter voltage of Q1 is kept constant by VR1, the emitter-base voltage increases. This causes Q1 to conduct more which means less base current for Q505. The voltage drop across Q505 becomes larger and the output remains constant.

When the input voltage starts to drop, the output voltage also tends to drop and Q1 will conduct less. This increases the forward bias on Q505 and reduces the voltage

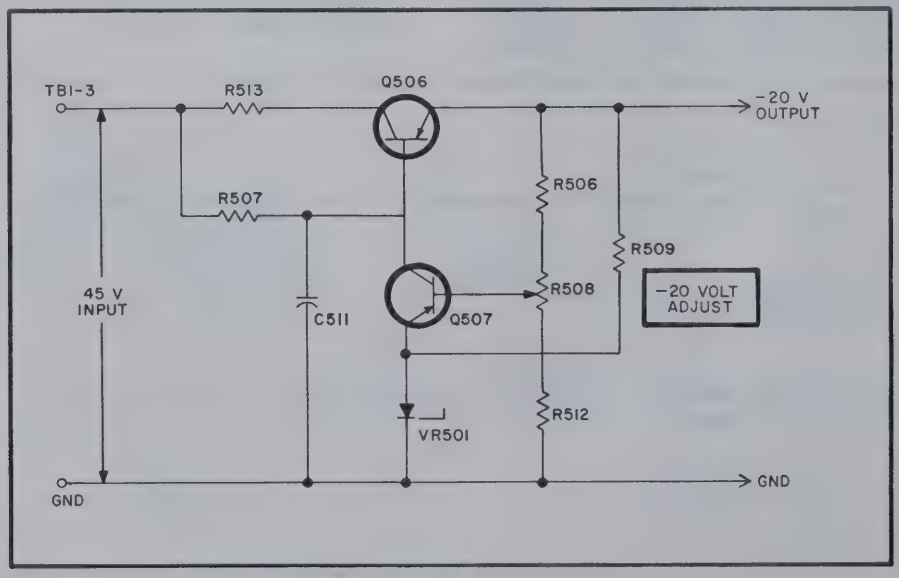


Figure 5 - -20 Volt Regulator Circuit

drop across Q505 to keep the output constant.

Diode CR1 gives reverse polarity protection to the supply. Potentiometer R4 is used to set the emitter-base voltage of Q1 for the desired 10-Volt ±5% output. R1 and R3 limit maximum current through Q1. R2 provides bias current for Zener diode VR1, and R7 provides bias for Q505, C1 and C3 prevent high frequency oscillation. The output voltage is metered at P505-7.

RECEIVER MUTING

Transistor Q2 on the 10-volt regulator board operates as a switch for the receiver muting +10 volts. When the transmitter is not keyed, the base of Q2 is connected to ground, causing Q2 to conduct. When conducting, the +10 volts at the collector of Q2 is coupled from P505 to the base of receiver DC amplifier Q9, turning it on. With Q9 conducting, Q10 is turned off, allowing the receiver to operate normally.

Keying the transmitter applies +12 volts to the base of the PNP muting switch (Q2), turning it off. This removes the +10 volts to receiver DC amplifier Q9, turning it off. Turning off Q9 causes DC amplifier Q10 to turn on, which turns off the receiver audio stages and mutes the receiver.

MAINTENANCE

HEAT SINK SERVICING

Since the metal envelopes of the transistors are at collector potential, they must be electrically isolated from ground. However, there must be a good path for heat from the transistors to reach the cast aluminum radiator (heat sink) in which they are mounted, so that the heat will be dissipated by the heat sink. The anodized aluminum spacers used between the transistors and their mounting plate not only isolate the transistors electrically, but also provide a good conductor to conduct heat away from them.

Silicone grease is used between the metal parts in the heat sink to improve contact between them and allow the heat to be transferred more readily.

NOTE

Whenever the transistor mounting plate is removed from the heat sink, be sure that there is sufficient silicone grease on the plate to make good contact with the heat sink before it is replaced. There should also be a coating of grease beneath the transistors and beneath the anodized aluminum spacers.

REINSTALLATION

If the mobile combination is ever moved to a different vehicle, be sure to check the battery polarity of the new system and, if necessary, change the power cable connections to the fuse assembly, as well as the ignition switch cable connections, to maintain current polarity.

DISASSEMBLY

To service the power supply --

1. Pull the locking handle down and pull radio out of mounting frame.
2. Remove the two screws in bottom cover and take off cover.

To remove the power supply from the system frame --

1. Complete Steps 1 and 2 above.
2. Remove the two Phillips-head retaining screws in the front casting, and pull casting away from system frame.
3. Pry power connector out of connector supporting bracket. Next, unplug the clip-on connectors to the system relay, and unplug systems connector at the back of the power supply.
4. Lift the Two-Way Radio away from power supply.

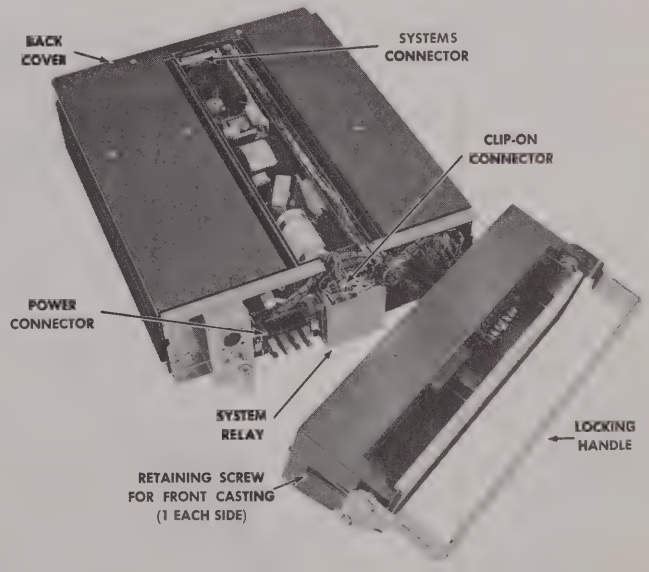
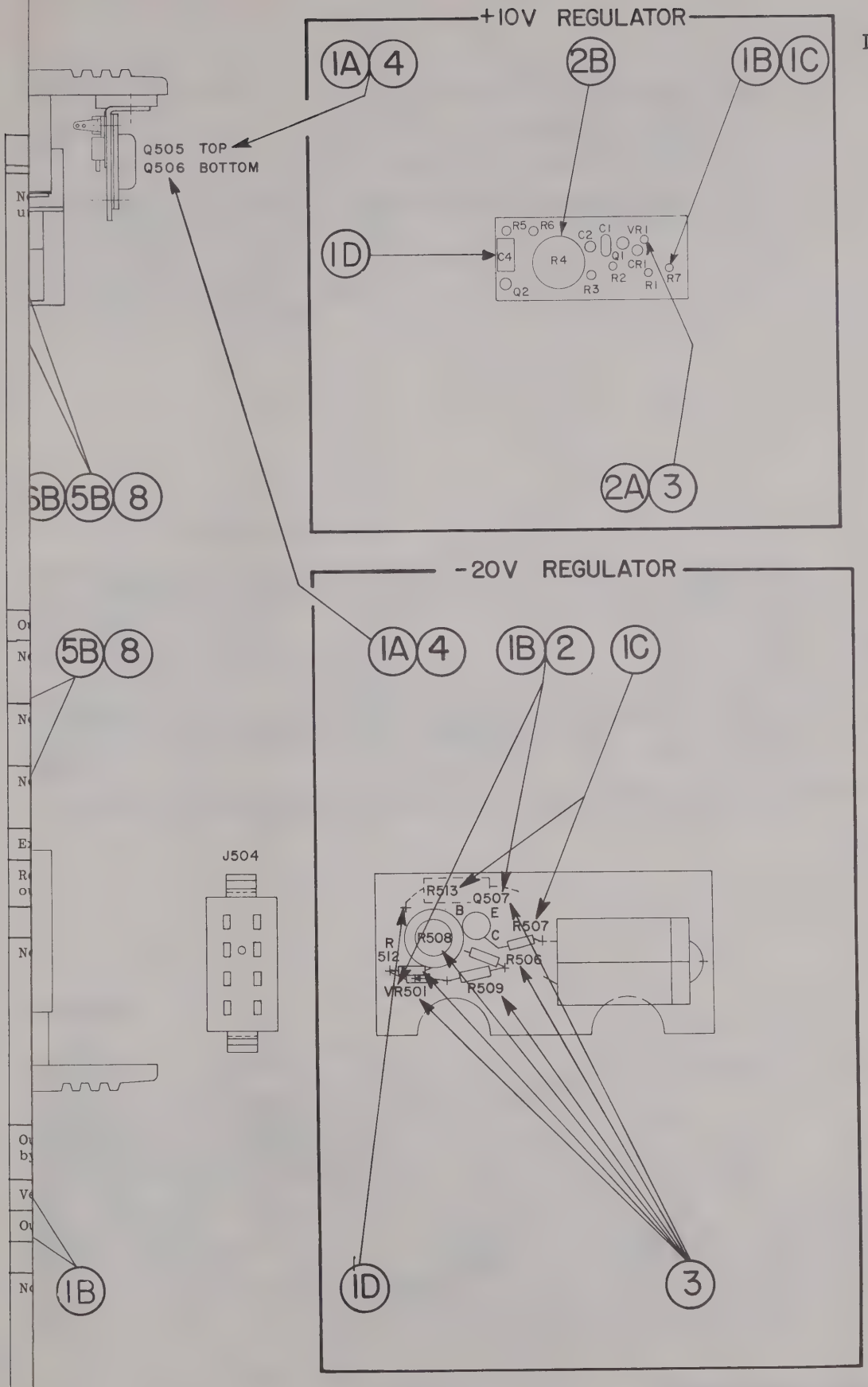


Figure 6 - Disassembly of Power Supply

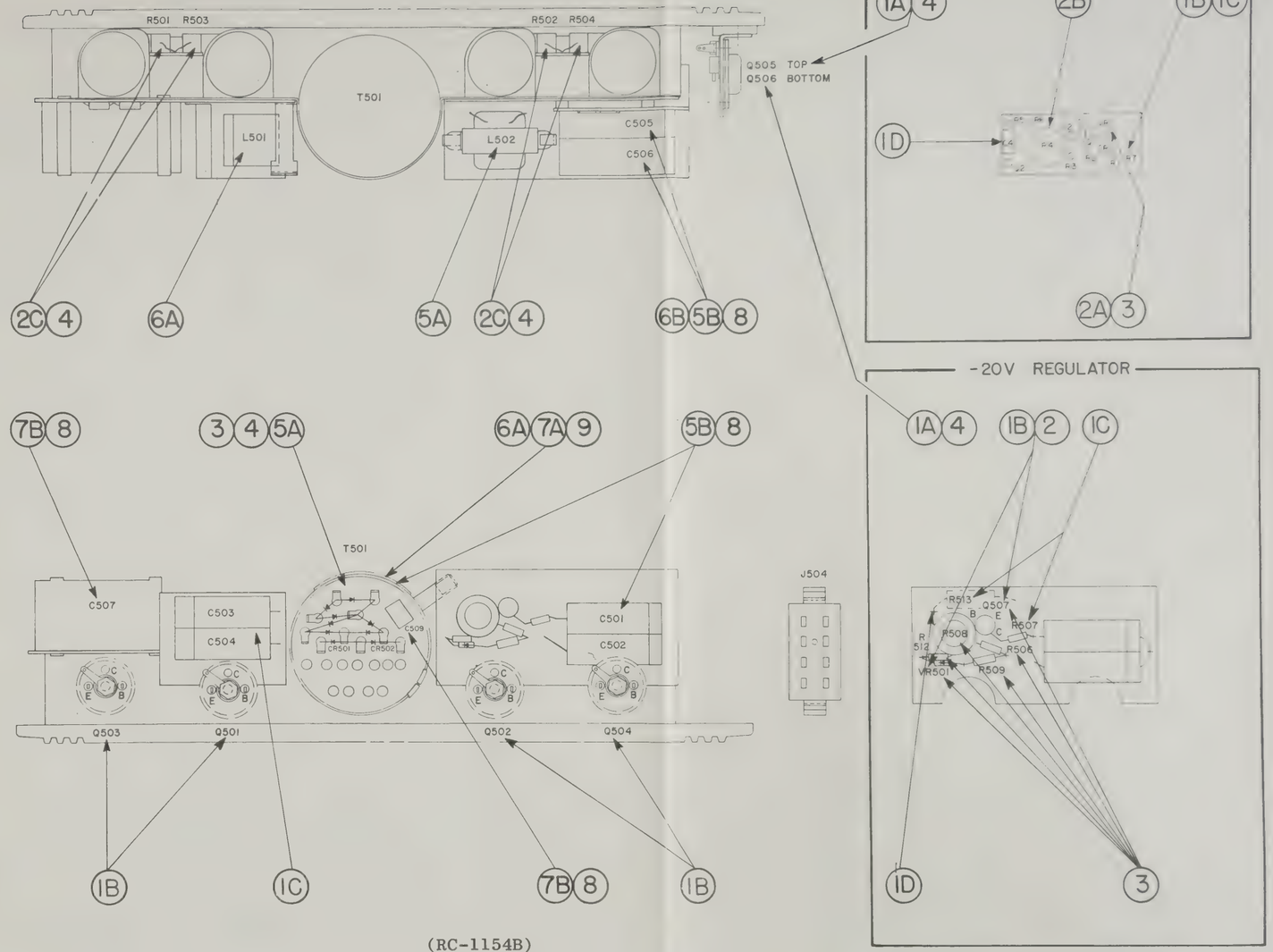


TROUBLESHOOTING PROCEDURE

70/90/100-WATT POWER SUPPLY
MODEL 4EP37A10

STEP 1 - QUICK CHECKS

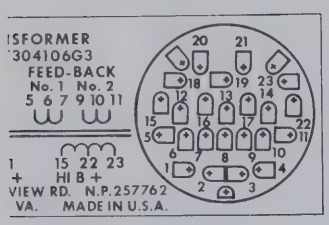
SYMPTOM	PROCEDURE
No power supply output voltages at P505 when unit is keyed	Check for 12 Volts at J504-3-5. Also check fuse F501. If O.K., go to Step 2; otherwise check: 1. A. Check fuse assembly for open circuit. If fuse is open check for: B. Collector-to-emitter short in Q501, Q502, Q503, Q504, primary wiring shorts. C. If an above transistor is shorted, check for shorted C504, C503.
	With 12 Volts at J504, check the following steps: 2. A. Open fuse in system cable. B. Keying relay in system should close when PTT switch is depressed. C. Open R501, R502, R503, R504.
	3. Check T501 for shorts and opens. Check for shorted winding turns by applying a 1/2-volt P-p from an audio signal generator to the primary winding T501. Check output of each secondary winding with a scope. No output indicates shorted turns.
Output voltages low	4. Open R501, R502, R503, R504, and diodes in affected circuit.
No -45 Volts at P505-2	5. A. Open CR501, CR502, L502, T501. B. Shorted C502, C501, T501.
No 300 Volts at P505-1	6. A. Open CR503, CR504, CR505, CR506, L501, T501. B. Shorted C505, C506.
No 650 Volts at P505-9	7. A. Open CR507 through CR510 (two or more), T501. B. Shorted C507, C509.
Excessive output ripple voltages	8. Open diodes, C501, C502, C505, C506, C507, C509.
Reverse or high output voltage on bias output	9. Check for shorts between bias output winding and B+ output winding of T501.
	10 VOLT REGULATOR
No 10-Volts regulated at P505-7	1. Check for the following: A. Open Q505. B. 12 Volts input. C. Open R7. D. Shorted C4. E. Open fuse in vehicle system.
Output voltage too high, cannot be adjusted by R6	2. A. Check for open VR1. B. Defective R4.
Very low output voltage	3. Check for a shorted VR1.
Output voltage equals input voltage	4. Shorted Q505.
	-20 VOLT REGULATOR
No -20 Volts regulated at P505-3	1. Check for the following: A. Open Q506. B. Shorted Q507 and/or VR501. C. Open R507, R513. D. -45 Volts at TB1-18.
Very low output voltage	2. Shorted Q507 or VR501.
Output voltage too high, cannot be adjusted by R508	3. Open VR501, Q507, R506, R508, R509, R512.
Output voltage equals input voltage	4. Shorted Q506.

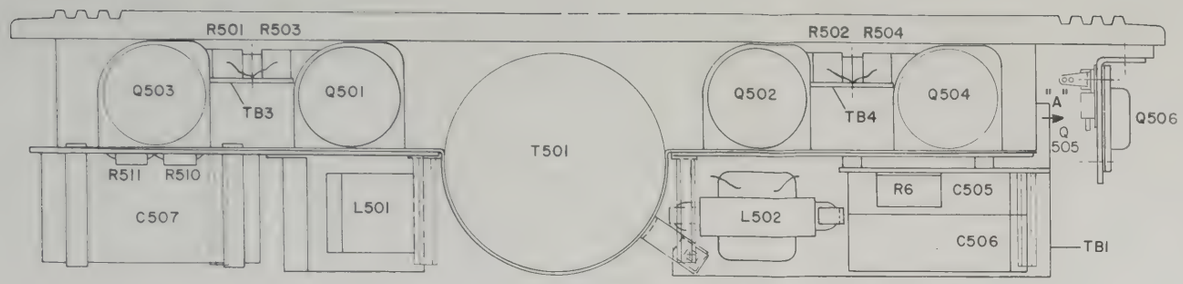


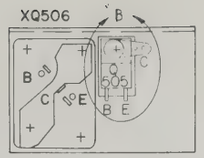
(RC-1154B)

LBI-3504

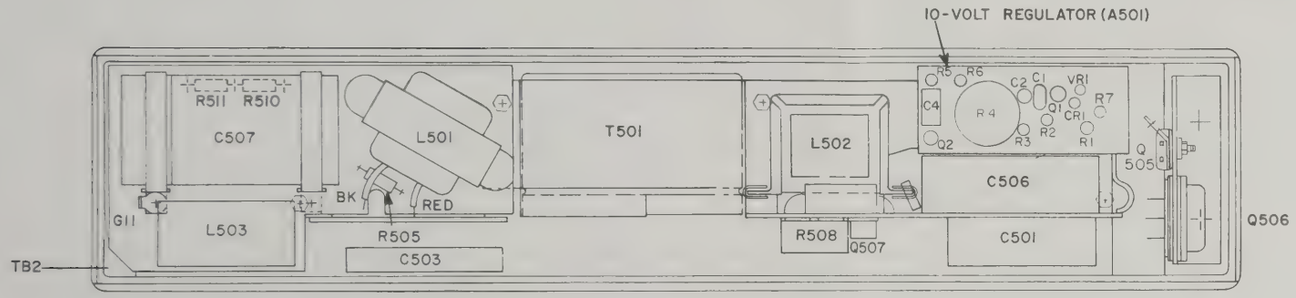
TROUBLESHOOTING PROCEDURE
70/90/100-WATT POWER SUPPLY
MODEL 4EP37A10

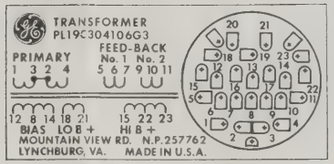

ISFORMER
'304106G3
FEED-BACK
No. 1 No. 2
5 6 7 9 10 11
1 15 22 23
+ HI B +
VIEW RD. N.P.257762
VA. MADE IN U.S.A.
20 21
18 19 23
12 13 14
15 16 17 22
5 11
6 7 8 9 10
1 4
2 3

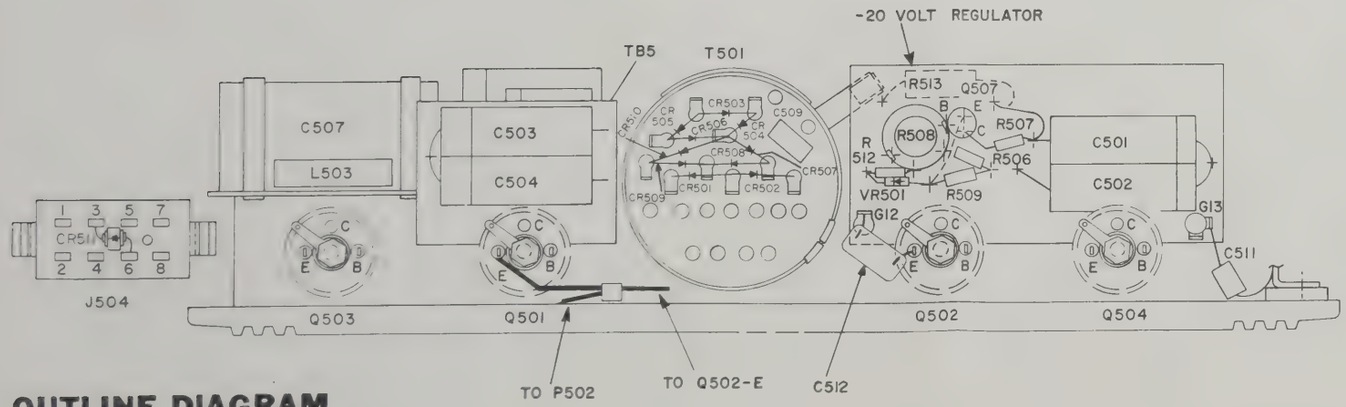




VIEW AT "A"

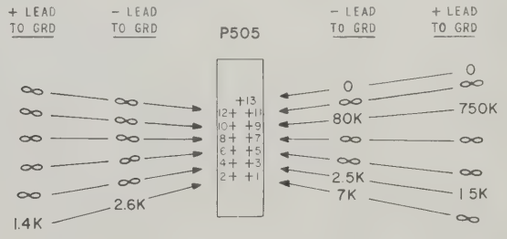






RESISTANCE READINGS

ALL RESISTANCE READINGS ARE TYPICAL READINGS
TAKEN WITH A 20,000 OHMS-PER-VOLT METER TO CHASSIS GROUND



OUTLINE DIAGRAM

70/90/100-WATT POWER SUPPLY
MODEL 4EP37A10

(19D402567, Rev. 11)

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P680J	Composition: 68 ohms ±5%, 1/2 w.
R3	3R77P242J	Composition: 2400 ohms ±5%, 1/2 w.
R4	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R5	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R6	19B209113P1	Variable, wirewound: 250 ohms ±20%, 2.5 w.
R8*	3R77P680K	Composition: 68 ohms ±10%, 1/2 w. Added by REV C.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P9	Silicon, Zener.
		- - - - - - - - - CAPACITORS - - - - - - - - -
C501 thru C504	19B209004P11	Polyester: 0.68 µf ±10%, 100 VDCW; sim to Sprague 157P68491.
C505 and C506	5491656P42	Polyester: 0.47 µf ±20%, 400 VDCW; sim to GE Type 61F.
C507	5491656P40	Polyester: 1 µf +30% -10%, 1000 VDCW; sim to GE Type 61F.
C509	19C301693P20	Ceramic disc: .006 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C511	19A115028P17	Polyester: 0.33 µf ±20%, 100 VDCW.
C512*	19A115028P14	Polyester: 0.1 µf ±20%, 200 VDCW. Added by REV B.
C513* and C514*	19A116087P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TT. Added by REV P.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR501 thru CR506	4037822P1	Silicon.
CR507 thru CR510	19A115845P4	Silicon.
CR511*	19A116783P1	Silicon. Added by REV U.
		- - - - - - - - - - FUSES - - - - - - - - - -
F501*	19A116658P14	Enclosed link: 6 amp at 250 v; sim to Bussman GJV 6. Added by REV U.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J504	19A121524G1	Connector, phen: 8 contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L501	19A121120P1	Reactor: 0.45 h +0.5 -.05 h min at 0.15 amp DC, 20 ohms ±10% DC res, 1000 v peak, 420 VDC operating.
L502	19B200777P1	Reactor: 0.1 h min at 0.15 amp DC, 12 ohms ±10% DC res, 720 v peak, 300 VDC operating.
L503	19A115391P1	Coil, RF: 50 µh ±10% ind at 1000 Hz, .02 ohm DC res max.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P501 and P502	19B209151P1	Terminal: solderless; sim to Amp 42284-5.
P505	19B204781P1	Female, phen: No. 1 thru 12 contacts rated at 2 amps at 850 VDC max, No. 13 contact rated at 4 amps at 450 VDC max.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q501 thru Q504	5490810P1	Germanium, PNP.

SYMBOL	GE PART
Q505*	19A116742P
	19A116203P
	19A116118P
	19A115948P
	19A115527P
	19A115267P
Q506	19A115341P
Q507*	19A115852P
	19A115768P
R501 and R502	5493035P3
R503 and R504	5493035P4
R505	3R77P222K
R506	3R77P751J
R507	3R77P822K
R508	19B209113P
R509	3R77P222K
R510 and R511	3R77P394K
R512	3R77P751J
R513	5493035P4
T501*	19C304106G
	19C304106G
TB1	19C303431G
TB2	19B204509G
TB3	19B204463G
TB4	19B204463G
TB5	19C303422G
VR501	4036887P6
XQ506	5491888P1
	19C303390

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - To protect the 10-volt regulator against reverse polarity. Added CR1 to the 10-volt regulator board A501.

REV. B - To suppress switching spikes in the power supply primary. Added C512.

REV. C - To improve operation of 10-volt regulator. Deleted Q1 and added R8 to the 10-volt regulator board A501.

REV. D - To improve reliability of 10-volt regulator. Changed Q505 and 10-volt regulator circuit (A501).

REV. E - To improve operation of 10-volt regulator A501. Changed R8.

REV. F - To provide tap for 120-watt input. Changed T501.

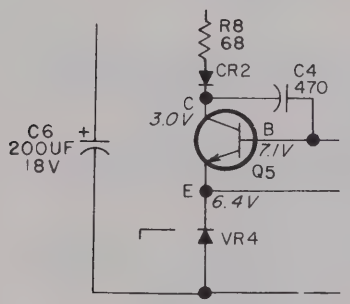
REV. G - To incorporate new transistor. Changed Q505.

REV. H - To reduce alternator noise. Changed A501.

REV. J - To provide reverse polarity protection. Deleted CR2 and added CR3 to 10-volt regulator A501

Schematic Diagram

Was



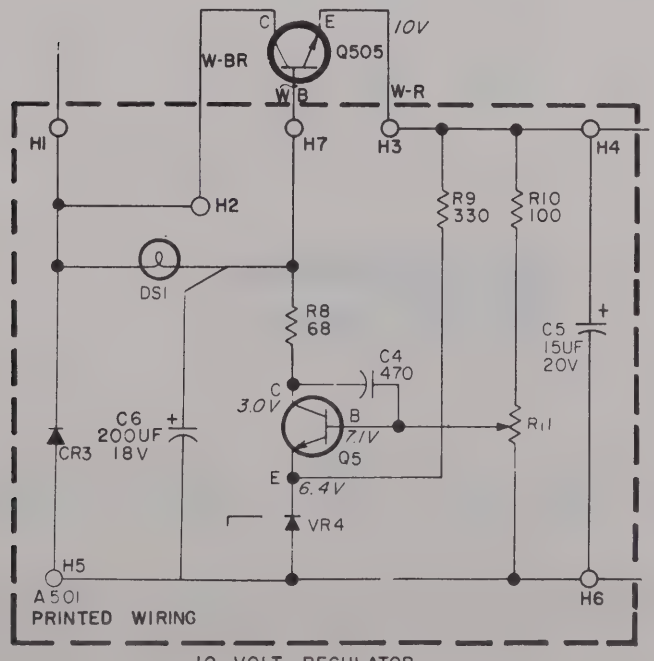
Rev. K - To incorporate a different transistor. Changed Q505.

Rev. L - To obtain a more reliable connection to the regulator transistor. Changed Q505.

Rev. M - To incorporate a transistor switch on the 10-volt regulator board for receiver muting. Added C4, R5, R6, Q2 and new regulator board.

Schematic Diagram

Was:



10-VOLT REGULATOR

PARTS LIST

LBI-3582K

12 VOLT, 70/90/100 WATT POWER SUPPLY
MODEL 4EP37A10

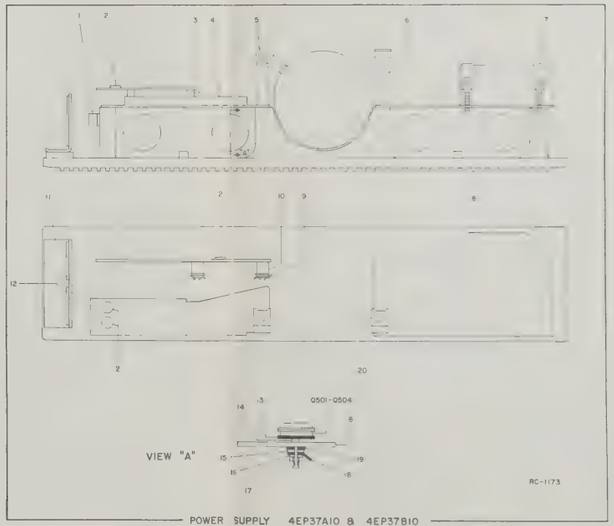
SYMBOL	GE PART NO.	DESCRIPTION
A501*		10 VOLT REGULATOR BOARD 19C311775G1
		- - - - - - - - CAPACITORS - - - - - - - -
C1	7774750P1	Ceramic disc: .00047 µf +100 -0%, 500 VDCW.
C2	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW: sim to Sprague Type 150D.
C3	19A115680P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TT.
C4	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	4037822P1	Silicon.
		- - - - - - - - INDICATING DEVICES - - - - - - -
DS1*	4034664P1	Lamp, incandescent: 28 v; sim to GE2148. Deleted by REV S.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1*	19A116755P1	Silicon, NPN: sim to Type 2N3947.
		In REV U and earlier:
	19A115123P1	Silicon, NPN: sim to Type 2N2712.
Q2*	19A115852P1	Silicon, PNP; sim to Type 2N3906.
		In REV U and earlier:
	19A115768P1	Silicon, PNP: sim to Type 2N3702.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P680K	Composition: 68 ohms ±10%, 1/2 w.
R2	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R3	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R4	19A115681P1	Variable, wirewound: 1000 ohms ±20%, 3 w; sim to CTS Series 115.
R5	3R77P104K	Composition: 0.10 megohm ±10%, 1/2 w.
R6*	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
		In REV M and earlier:
	3R77P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R7*	3R77P221J	Composition: 220 ohms ±5%, 1/2 w. Added by REV S.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	4036887P6	Silicon, Zener.
		IN REV H thru L:
A501*		10 VOLT REGULATOR BOARD 19C303420G7
		- - - - - - - - - CAPACITORS - - - - - - - - -
C4	7774750P1	Ceramic disc: .00047 µf +100 -0%, 500 VDCW.
C5	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW.
C6	19A115680P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TT.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR3	4037822P1	Silicon.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INDICATING DEVICES - - - - - - -
DS1	4034664P1	Lamp, incandescent: 28 v; sim to GE2148.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q5	19A115123P1	Silicon, NPN: sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R8	3R77P680K	Composition: 68 ohms ±10%, 1/2 w.
R9	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R10	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R11	19A115681P1	Variable, wirewound: 1000 ohms ±20%, 3 w; sim to CTS Series 115.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR4	4036887P6	Silicon, Zener.
		IN REV D thru G:
A501*		10 VOLT REGULATOR BOARD 19C303420G6
		- - - - - - - - - CAPACITORS - - - - - - - - -
C4	7774750P1	Ceramic disc: .00047 µf +100 -0%, 500 VDCW.
C5	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR2*	19A115250P1	Silicon. Deleted by REV J.
CR3*	4037822P1	Silicon. Added by REV J.
		- - - - - - - - INDICATING DEVICES - - - - - - -
DS1	4034664P1	Lamp, incandescent: 28 v; sim to GE 1762D.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q5	19A115123P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R8*	3R77P680K	Composition: 68 ohms ±10%, 1/2 w.
		In REV D:
	3R77P161J	Composition: 160 ohms ±5%, 1/2 w.
R9	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R10	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R11	19A115681P1	Variable, wirewound: 1000 ohms ±20%, 2.2 w; sim to CTS Series 115.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR4	4036887P6	Silicon, Zener.
		IN REV C AND EARLIER
A501*		REGULATOR COMPONENT BOARD ASSEMBLY 19C303420G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	4037822P1	Silicon.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1*	4037993P1	Germanium, PNP; sim to Type 2N1303. Deleted by REV C.
Q2	19C300073P2	Germanium, PNP; sim to Type 2N1414.
Q3	19A115123P1	Silicon, NPN; sim to Type 2N2712.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P680J	Composition: 68 ohms ±5%, 1/2 w.
R3	3R77P242J	Composition: 2400 ohms ±5%, 1/2 w.
R4	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R5	3R77P681J	Composition: 680 ohms ±5%, 1/2 w.
R6	19B209113P1	Variable, wirewound: 250 ohms ±20%, 2.5 w.
R8*	3R77P680K	Composition: 68 ohms ±10%, 1/2 w. Added by REV C.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	4036887P9	Silicon, Zener.
		- - - - - - - - - CAPACITORS - - - - - - - - -
C501 thru C504	19B209004P11	Polyester: 0.68 µf ±10%, 100 VDCW; sim to Sprague 157P68491.
C505 and C506	5491656P42	Polyester: 0.47 µf ±20%, 400 VDCW; sim to GE Type 61F.
C507	5491656P40	Polyester: 1 µf +30% -10%, 1000 VDCW; sim to GE Type 61F.
C509	19C301693P20	Ceramic disc: .006 µf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C511	19A115028P17	Polyester: 0.33 µf ±20%, 100 VDCW.
C512*	19A115028P14	Polyester: 0.1 µf ±20%, 200 VDCW. Added by REV B.
C513* and C514*	19A116087P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TT. Added by REV P.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR501 thru CR508	4037822P1	Silicon.
CR507 thru CR510	19A115845P4	Silicon.
CR511*	19A116783P1	Silicon. Added by REV U.
		- - - - - - - - - - FUSES - - - - - - - - - -
F501*	19A116658P14	Enclosed link: 6 amp at 250 v; sim to Bussman GJV 6. Added by REV U.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J504	19A121524G1	Connector, phen: 8 contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L501	19A121120P1	Reactor: 0.45 h +0.5 -.05 h min at 0.15 amp DC, 20 ohms ±10% DC res, 1000 v peak, 420 VDC operating.
L502	19B200777P1	Reactor: 0.1 h min at 0.15 amp DC, 12 ohms ±10% DC res, 720 v peak, 300 VDC operating.
L503	19A115391P1	Coil, RF: 50 µh ±10% ind at 1000 Hz, .02 ohm DC res max.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P501 and P502	19B209151P1	Terminal: solderless; sim to Amp 42284-5.
P505	19B204781P1	Female, phen: No. 1 thru 12 contacts rated at 2 amps at 850 VDC max, No. 13 contact rated at 4 amps at 450 VDC max.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q501 thru Q504	5490810P1	Germanium, PNP.

SYMBOL	GE PART NO.	DESCRIPTION
Q505*	19A116742P1	Silicon, NPN.
		In REV L-U:
	19A116203P3	Silicon, NPN.
		In REV K:
	19A116118P1	Silicon, NPN.
		In REV G, H and J:
	19A115948P1	Silicon, NPN.
		In REV D, E and F:
	19A115527P1	Germanium, PNP.
		In REV C and earlier:
	19A115267P1	Germanium, PNP.
Q506	19A115341P1	Germanium, PNP.
Q507*	19A115852P1	Silicon, PNP; sim to Type 2N3906.
		In REV U and earlier:
	19A115768P1	Silicon, PNP; sim to Type 2N3702.
		- - - - - - - - - RESISTORS - - - - - - - - -
R501 and R502	5493035P3	Wirewound, ceramic: 2 ohms ±5%, 5 w; sim to Hamilton Hall Type HR.
R503 and R504	5493035P4	Wirewound, ceramic: 80 ohms ±5%, 5 w; sim to Hamilton Hall Type HR.
R505	3R77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R506	3R77P751J	Composition: 750 ohms ±5%, 1/2 w.
R507	3R77P822K	Composition: 8200 ohms ±10%, 1/2 w.
R508	19B209113P3	Variable, wirewound: 1000 ohms ±20%, 2.5 w.
R509	3R77P222K	Composition: 2200 ohms ±10%, 1/2 w.
R510 and R511	3R77P394K	Composition: 0.39 megohm ±10%, 1/2 w.
R512	3R77P751J	Composition: 750 ohms ±5%, 1/2 w.
R513	5493035P4	Wirewound, ceramic: 80 ohms ±5%, 5 w; sim to Hamilton Hall Type HR.
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T501*	19C304106G3	Transformer.
		In REV E and earlier:
	19C304106G1	Transformer.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	19C303431G1	Eyelet board.
TB2	19B204509G1	Eyelet board.
TB3	19B204463G1	Eyelet board.
TB4	19B204463G2	Eyelet board.
TB5	19C303422G1	Eyelet board.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR501	4036887P6	Silicon, Zener.
		- - - - - - - - - SOCKETS - - - - - - - - -
XQ506	5491888P1	Transistor, power, phen: sim to Cinch 133-92-10-034.
		HARNESS ASSEMBLY 19D402277G3 (Includes C511, CR511, J504, P501, P502, P505, Q505, XQ506).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19C303390P2	Power Supply cover.

SYMBOL	GE PART NO.	DESCRIPTION
		MECHANICAL PARTS (SEE RC-1173)
1	7763541P4	Cable clamp. (Used with P505 cable).
2	4036555P1	(Not Used).
3	7140624P6	Spacer. (Used with A501).
4	19C303429P1	Support. (Used with A501).
5	7160861P2	Speed nut: spring; sim to Tinnerman C880-632-157. (Used with T501).
6	19A121220P1	(Not Used).
7	19B204454G1	(Not Used).
8	19D402261P1	Heat sink.
9	7160861P10	(Not Used).
10	7.42162P89	(Not Used).
11	19B204431P1	Support. (Used with Q506).
12	4029974P1	Transistor insulator. (Used with Q505 and Q506).
13	4031291P1	Transistor insulator. (Used with Q501 and Q502).
14	4034215P1	Bushing. (Used with Q501 and Q502).
15	4024225P1	Flat washer. (Used with Q501 and Q502).
16	N405P9C13	Lockwasher. No. #0. (Used with Q501 and Q502).
17	4032596P1	Nut. No. 10-32. (Used with Q501 and Q502).
18	4036835P1	Solder terminal: sim to Shakeproof 214-14-000. (Used with Q501 and Q502).
19	19A115221P3	Mica washer. (Used with Q501 and Q502).
20	7160861P4	(Not Used).



POWER SUPPLY 4EP37A10 & 4EP37B10

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - To protect the 10-volt regulator against reverse polarity. Added CR1 to the 10-volt regulator board A501.

REV. B - To suppress switching spikes in the power supply primary. Added C512.

REV. C - To improve operation of 10-volt regulator. Deleted Q1 and added R8 to the 10-volt regulator board A501.

REV. D - To improve reliability of 10-volt regulator. Changed Q505 and 10-volt regulator circuit (A501).

REV. E - To improve operation of 10-volt regulator A501. Changed R8.

REV. F - To provide tap for 120-watt input. Changed T501.

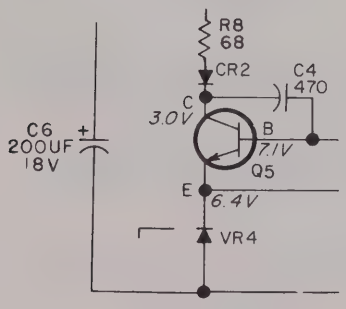
REV. G - To incorporate new transistor. Changed Q505.

REV. H - To reduce alternator noise. Changed A501.

REV. J - To provide reverse polarity protection. Deleted CR2 and added CR3 to 10-volt regulator A501

Schematic Diagram

Was



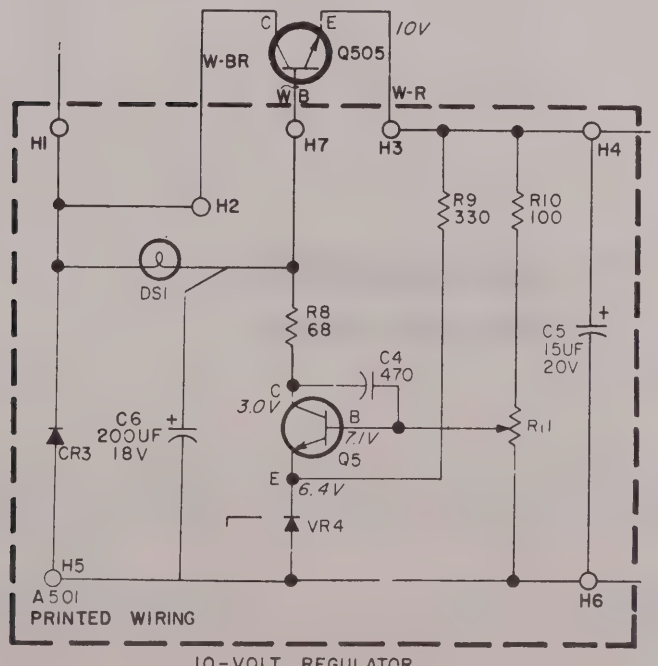
Rev. K - To incorporate a different transistor. Changed Q505.

Rev. L - To obtain a more reliable connection to the regulator transistor. Changed Q505.

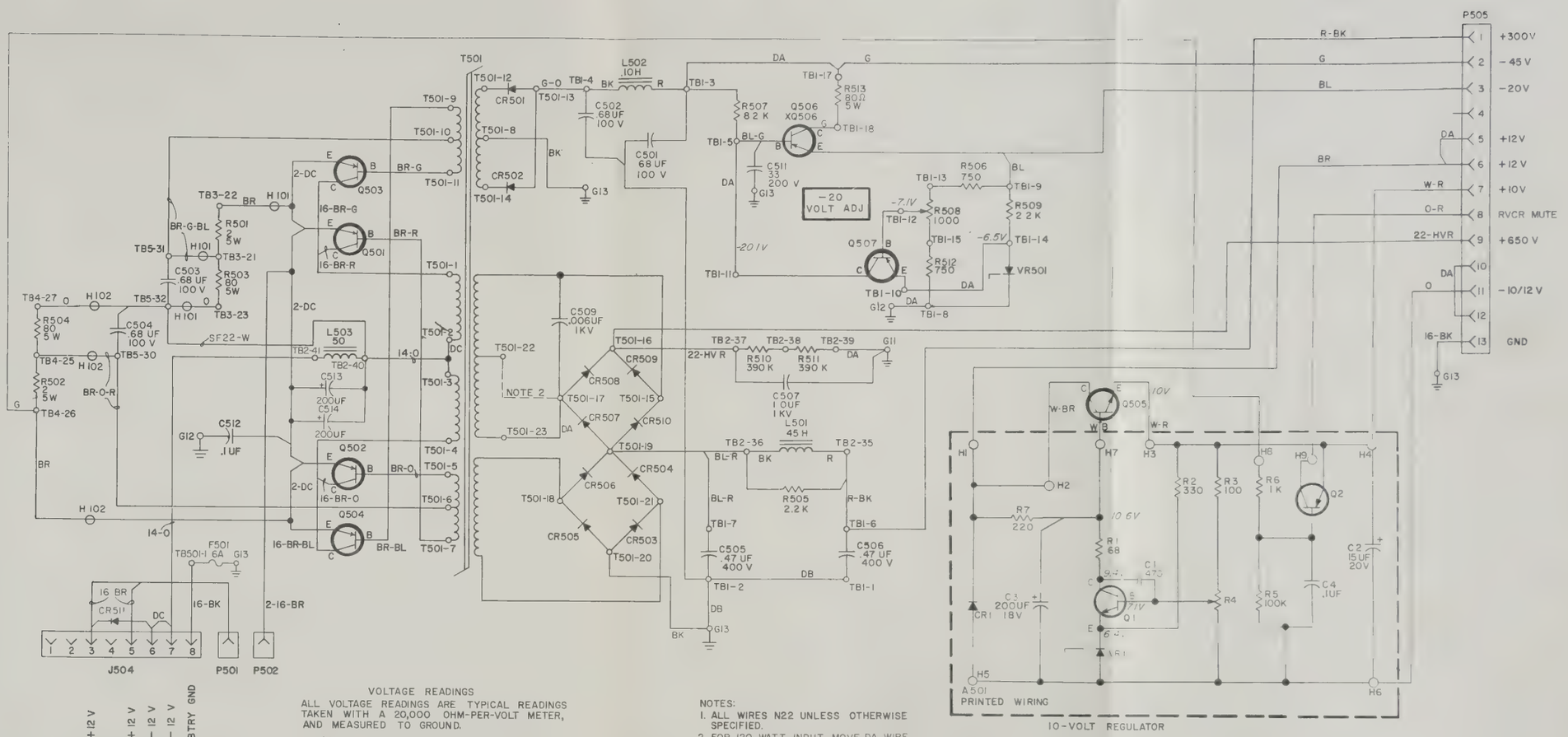
Rev. M - To incorporate a transistor switch on the 10-volt regulator board for receiver muting. Added C4, R5, R6, Q2 and new regulator board.

Schematic Diagram

Was:



10-VOLT REGULATOR



VOLTAGE READINGS

ALL VOLTAGE READINGS ARE TYPICAL READINGS TAKEN WITH A 20,000 OHM-PER-VOLT METER, AND MEASURED TO GROUND.

NOTES:
1. ALL WIRES N22 UNLESS OTHERWISE SPECIFIED.
2. FOR 120 WATT INPUT, MOVE DA WIRE FROM T501-23 TO T501-22

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H= HENRYS

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
4EP37A10	V

(19D402304, Rev. 27)

SCHEMATIC DIAGRAM

70/90/100-WATT POWER SUPPLY
MODEL 4EP37A10

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - To protect the 10-volt regulator against reverse polarity. Added CR1 to the 10-volt regulator board A501.

REV. B - To suppress switching spikes in the power supply primary. Added C512.

REV. C - To improve operation of 10-volt regulator. Deleted Q1 and added R8 to the 10-volt regulator board A501.

REV. D - To improve reliability of 10-volt regulator. Changed Q505 and 10-volt regulator circuit (A501).

REV. E - To improve operation of 10-volt regulator A501. Changed R8.

REV. F - To provide tap for 120-watt input. Changed T501.

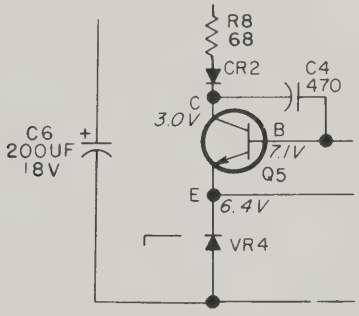
REV. G - To incorporate new transistor. Changed Q505.

REV. H - To reduce alternator noise. Changed A501.

REV. J - To provide reverse polarity protection. Deleted CR2 and added CR3 to 10-volt regulator A501

Schematic Diagram

Was



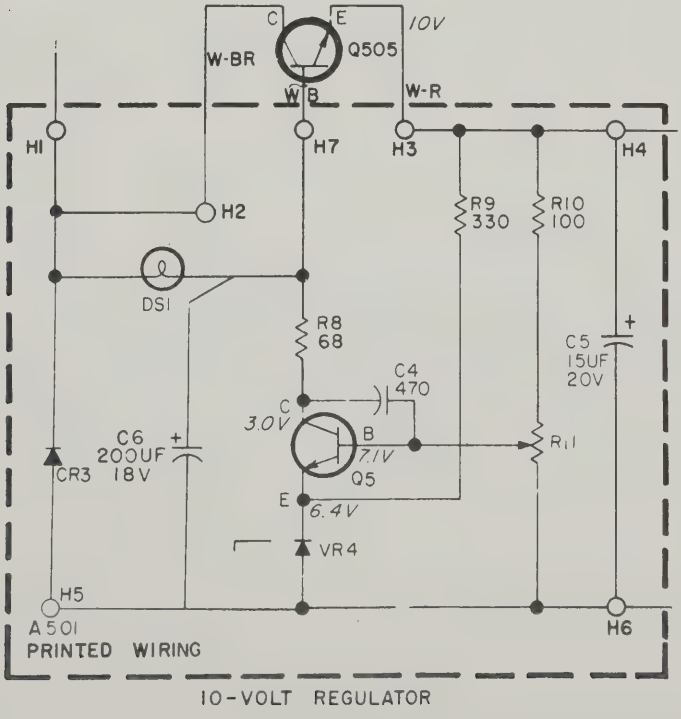
Rev. K - To incorporate a different transistor. Changed Q505.

Rev. L - To obtain a more reliable connection to the regulator transistor. Changed Q505.

Rev. M - To incorporate a transistor switch on the 10-volt regulator board for receiver muting. Added C4, R5, R6, Q2 and new regulator board.

Schematic Diagram

Was:

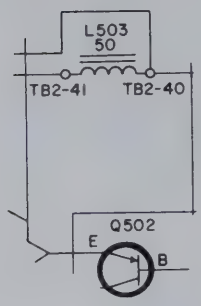


10-VOLT REGULATOR

REV. N - To insure muting of the receiver when operating below 20% of the battery voltage. Changed R6.

REV. P - To reduce residual spike deviation. Added C513 and C514.

Schematic Diagram was



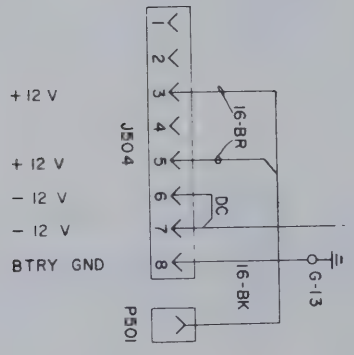
REV. R - To improve performance and mechanical construction. Added standoffs. Changed cover and DA wire between TB5-32 and TB2-40.

REV. S - To solve procurement problem.
10 Volt Regulator Board, 19C317751G1
Deleted DS1 and added R7.
10 Volt Regulator Board, 19C303420G6
Deleted DS1 and added R12.

REV. T - To improve filtering.
Changed connection of C513 and C514.

REV. U - To provide reverse polarity protection.
Added CR511, F501 and TB501.

Schematic Diagram was:



REV. V - To incorporate new transistors.
10Volt Regulator Board, 19C317751G1
Changed Q1 and Q2.

Harness Assembly, 19D402277G3
Changed Q505.

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MAINTENANCE MANUAL

LBI-3504

DF-0059

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

PRINTED IN U.S.A.

MOBILE RADIO

MASTR Progress Line

MOBILE CONTROL UNIT MODELS 4EC59A10-25

SPECIFICATIONS *

MODEL NUMBERS	4EC59A10 through 4EC59A25
USED WITH	MASTR Professional Series Mobile Combinations
CONTROLS	VOLUME Control
	OFF-ON-STBY Switch
	SQUELCH Control
	Optional Controls
	Two-Frequency Selector Switch
	CHANNEL GUARD Monitor Switch
	SPEAKER-OFF Monitor Switch
	Dimmer Control for Pilot Lights
INDICATORS	Transmitter filament-on light: green
	Transmit light: red

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

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Control Unit Model 4EC59A10——25
Power Cables (6-, 12- & 28-Volt)
Trunk-Mount Control Cables 19C303626-G1—— -G4
Vehicle System Cables 19A121454-G1 & -G2
Interconnection Harness 19A121650-G1
Microphone Model 4EM25A10
Handset Model 4EM26A10
Dimmer Control Option 19A121293-G1
Relay Assembly 19B204624-G1
Five-Watt Speaker 4EZ16A19

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ILLUSTRATIONS

Figure 1	12-VDC Connections for Ignition Switch Standby	2
Figure 2	Disassembly of Control Cable Plug	3

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power.

KEEP AWAY FROM LIVE CIRCUITS

DESCRIPTION

MASTR Progress Line Control Units are compact, highly functional control units that are designed for either Trunk-Mount or Front-Mount MASTR mobile combinations.

In Trunk-Mount installations, a plate is installed on the back of the Control Unit to hold the connectors. A mounting bracket is provided for mounting the Control Unit within convenient reach of the operator. In Front-Mount installations, the Control Unit is attached to the front of the MASTR Two-Way Radio.

Cable connections are secured to the Control Unit by means of captive locking screws.

CIRCUIT ANALYSIS

The OFF-ON-STBY (standby) switch determines whether or not the transmitter and receiver are operative. With the switch in the OFF position, all power is removed from the Two-Way Radio. Turning the switch to STBY applies power to the receiver only, and the green pilot light does not light.

Turning the switch to the ON position applies filament voltage to the transmitter, activates the push-to-talk (PTT) circuit, and lights the green pilot light. After a short warm-up time, the PTT button may be pressed to key the transmitter.

Pushing the PTT button energizes the system relay, which, in turn, starts the power supply, switches the antenna and mutes the receiver. Keying the transmitter also lights the red pilot light.

CONTROLS

All models of the Control Unit have VOLUME and SQUELCH controls, and an OFF-ON-STBY switch. Depending on the model number, some of the Control Units may have one or more of the controls described in the following paragraphs. A chart showing which controls are present on each Control Unit model is provided on the Control Unit Wiring Diagram.

Instructions for adjusting the controls are in the Operator's Manual for the Two-Way Radio.

Two-Frequency Switch (S704)

For two-frequency operation, a frequency selector switch selects the channel desired (F1 or F2) for both transmitting and receiving. The switch connects +10 volts to the selected receiver oscillator switching diode and connects the transmitter oscillator switching diode to ground, so that the unit will operate on the frequency determined by each of the crystal-controlled oscillators.

In two-frequency radios, the transmitter and receiver Channel Guard will operate only when the frequency selector switch is in the F1 position.

SPEAKER-OFF Switch (S702)

The SPEAKER-OFF switch is used whenever a telephone handset and hookswitch is used. The switch operates in parallel with the hookswitch and, in the SPEAKER position, overrides the speaker muting circuit in the handset hookswitch. Calls can then be heard from the speaker, regardless of whether the handset is on or off the hookswitch.

With the switch in the OFF position and the handset off the hookswitch, calls are heard only from the handset earpiece. The speaker still operates with the handset hung up.

CHANNEL GUARD-OFF Switch (S703)

Placing this switch in the OFF position disables the receiver Channel Guard so that the receiver operates on noise squelch only.

Dimmer Control (R705 - Optional)

The dimmer control is a rheostat in series with the green pilot light. Turning the control adjusts the amount of light given off by the green pilot light.

12-VOLT SYSTEMS

In 12-volt vehicle systems, the Control Unit may be connected for three different modes of operation, depending on the way the three ignition switch cables are connected in the vehicle system. The black ignition switch cable provides the receiver ground connection. The yellow fused lead provides the receiver hot connections, and the red fused lead provides the hot connections for the transmitter filaments. The three types of operation are:

1. Ignition Switch Standby - For this type of operation, the red fused lead (transmitter filament voltage) is connected to the ACCESSORY or ON terminal

of the ignition switch. The yellow fused lead (receiver hot) is connected to the hot side of the ignition switch, and the black lead connects to vehicle ground.

With the ignition switch OFF, the receiver automatically reverts to STBY, ready to receive messages. Turning the ignition switch to the ON or ACCESSORY position turns on the green pilot light and supplies transmitter filament voltage. Turning the OFF-ON-STBY switch to OFF removes all power to the Two-Way Radio.

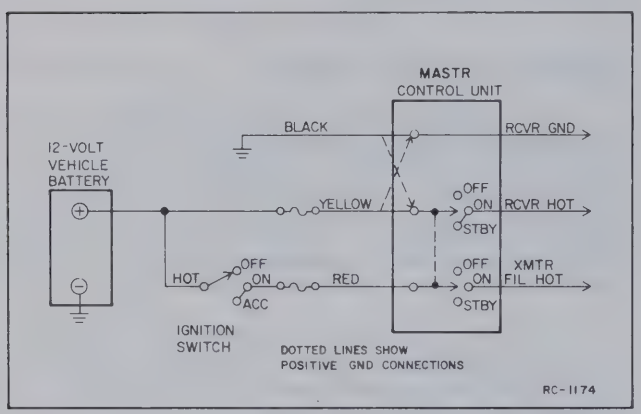


Figure 1 - 12-VDC Connections for Ignition Switch Standby

2. Ignition Switch Control - For ignition switch control, the yellow and red fused leads are connected to the ACCESSORY or ON terminal of the ignition switch. The transmitter and receiver will operate only when the ignition switch is in the ACCESSORY or ON position. Turning the ignition switch OFF removes all power to the radio.

3. Ignition Switch Bypass - For ignition switch bypass, the yellow and red fused leads connect to the "hot" side of the ignition switch or the vehicle fuse block assembly. Both the transmitter and receiver operate independently of the ignition switch and can be turned on and off only by the OFF-ON-STBY switch on the MASTR Control Unit.

6-AND 28-VOLT SYSTEMS

In 6- and 28-volt systems, the Control Unit may be connected for two different modes of operation, depending on the way the two ignition switch cables are connected in the vehicle system. The black cable provides the connection from the relay coil on the fuse assembly to the control head. The yellow fused lead provides the hot connection to operate the relay. The two types of operation are:

1. Ignition Switch Control - For ignition switch control, the yellow fused lead connects to the ON or ACCESSORY terminal of the ignition switch. The transmitter and receiver will operate only when the ignition switch is in the ON or ACCESSORY position. Turning the ignition switch OFF removes all power to the radio.

2. Ignition Switch Bypass - For ignition switch bypass, the yellow fused lead connects to the "hot" side of the ignition switch or vehicle fuse block assembly. Both the transmitter and receiver operate independently of the ignition switch, and can be turned on and off only by the OFF-ON-STBY switch on the MASTR Control Unit.

MAINTENANCE

DISASSEMBLY

In Trunk-Mount installations, access to the inside of the Control Unit is obtained by removing the two Phillips-head screws in the back of the unit and pulling the back panel away from the housing.

In Front-Mount installation, remove the two Phillips-head screws holding the front casting to the frame and move the casting away from the frame. Next, remove the two screws securing the control cable plug to the inside of the front casting. Then remove the two flat-head screws holding the Control Unit to the front casting.

PILOT LIGHT REPLACEMENT

The pilot lights can be easily replaced without disassembling the Control Unit. First, unscrew the colored lens. Then wrap a small piece of masking tape around the bulb, to give the fingers a firm grip, and unscrew the bulb.

REINSTALLATION

If it becomes necessary to move the Two-Way Radio and Control Unit to another vehicle, the 25-pin control cable plug may need to be disassembled.

Refer to Figure 2 for disassembly of the plug.

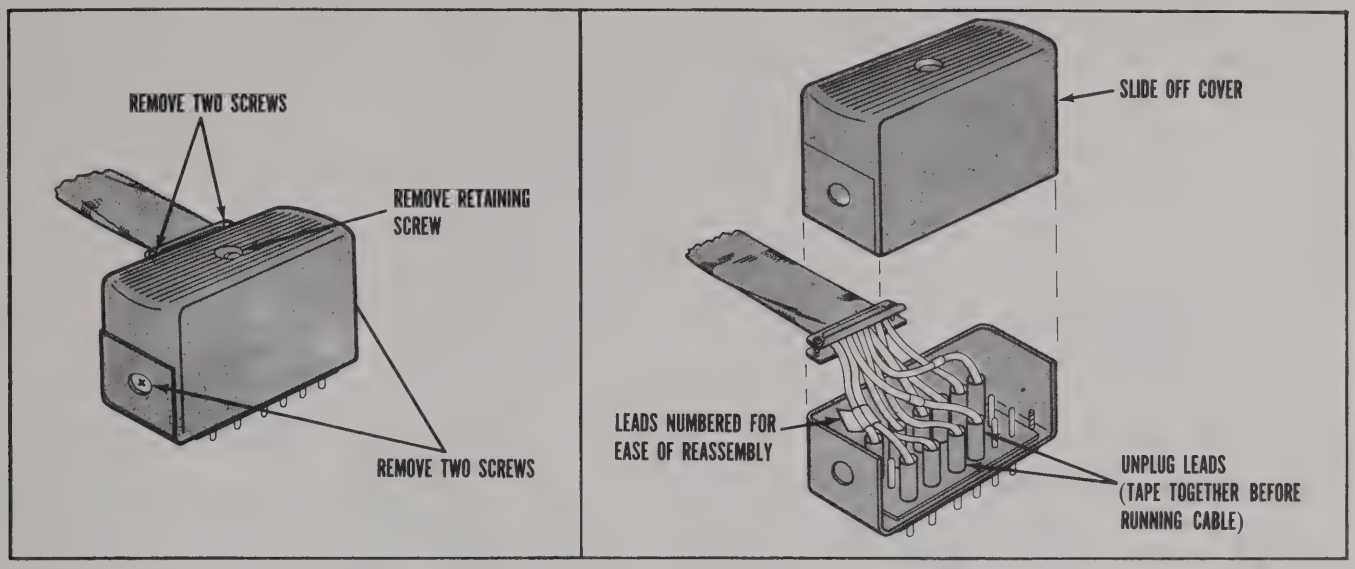
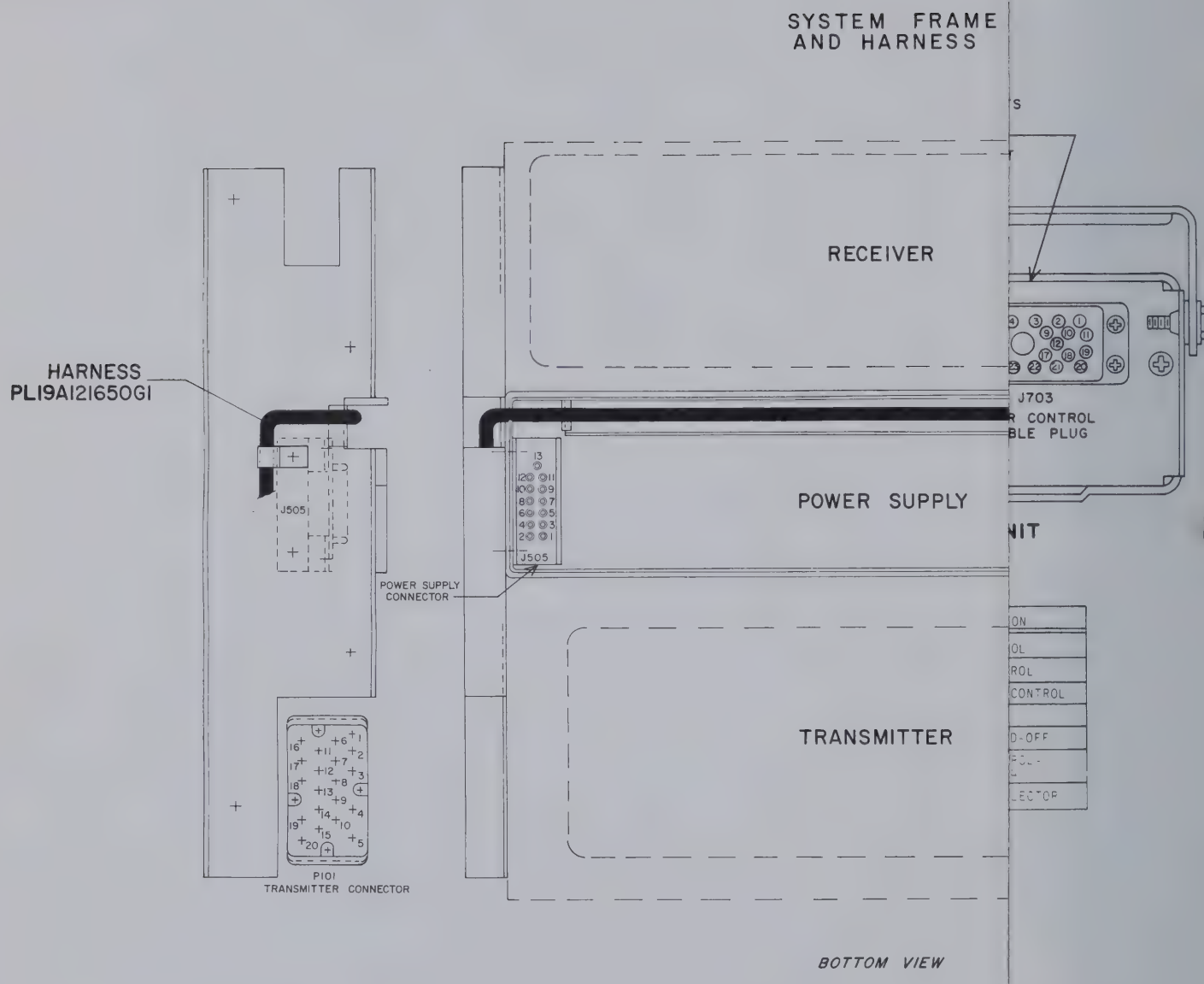

REMOVE TWO SCREWS
REMOVE RETAINING SCREW
REMOVE TWO SCREWS
SLIDE OFF COVER
LEADS NUMBERED FOR EASE OF REASSEMBLY
UNPLUG LEADS (TAPE TOGETHER BEFORE RUNNING CABLE)

Figure 2 - Disassembly of Control Cable Plug

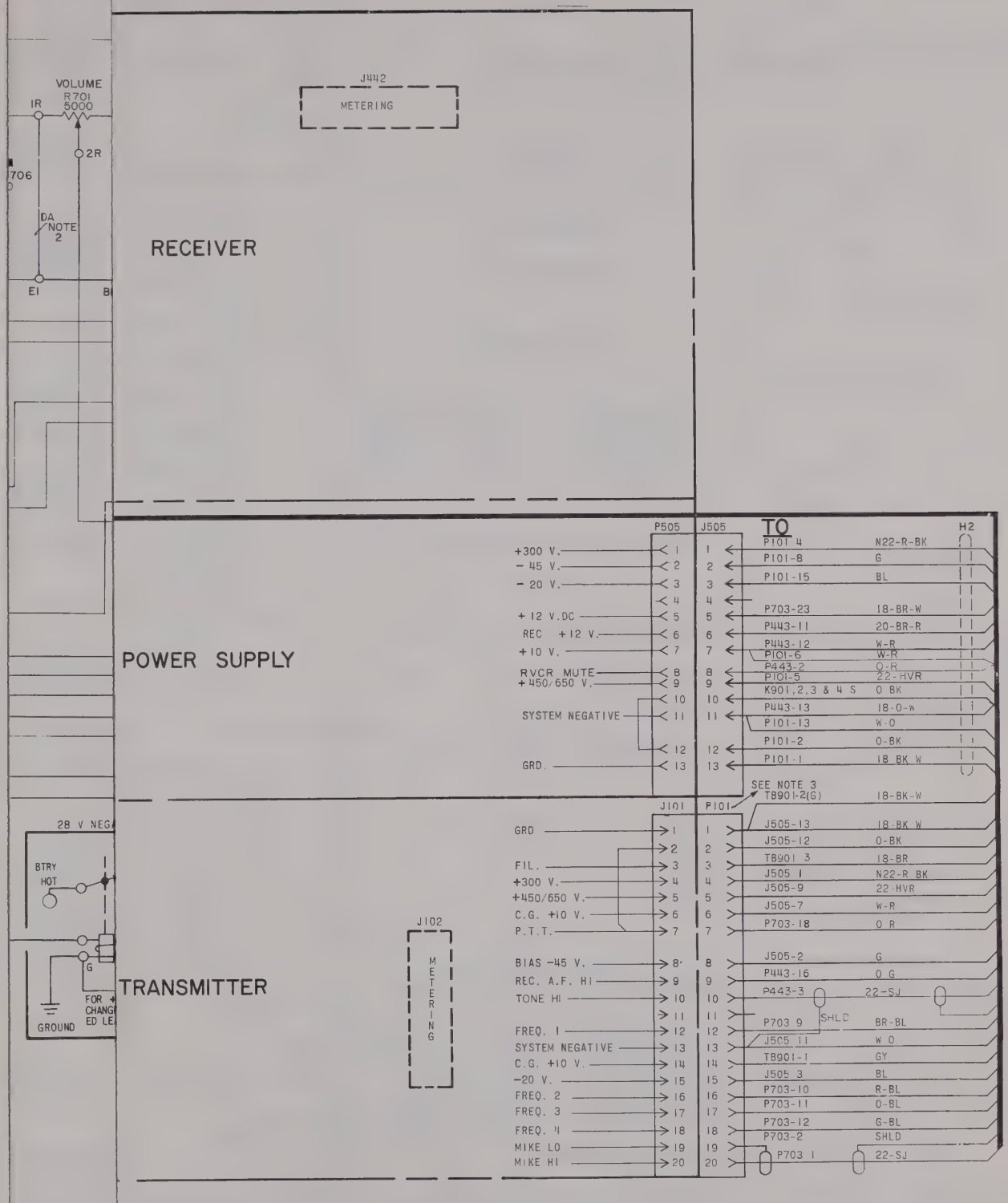
NOTE

The plug is assembled so that the cable comes out of the top of the plug when connected to the Control Unit. To have the cable come out of the bottom of the plug, remove the remaining two screws and rotate the metal frame 180 degrees.



OUTLINE DIAGRAM

MASTR CONTROL UNIT
MODELS 4EC59A10-25



RES ARE SF24 EXCEPT AS OTHERWISE SHOWN.
D402476 FOR ORIENTATION AND LOCATION
PONENTS AND ROUTING OF CABLE.
A121837P1 FOR CONNECTIONS OF P101

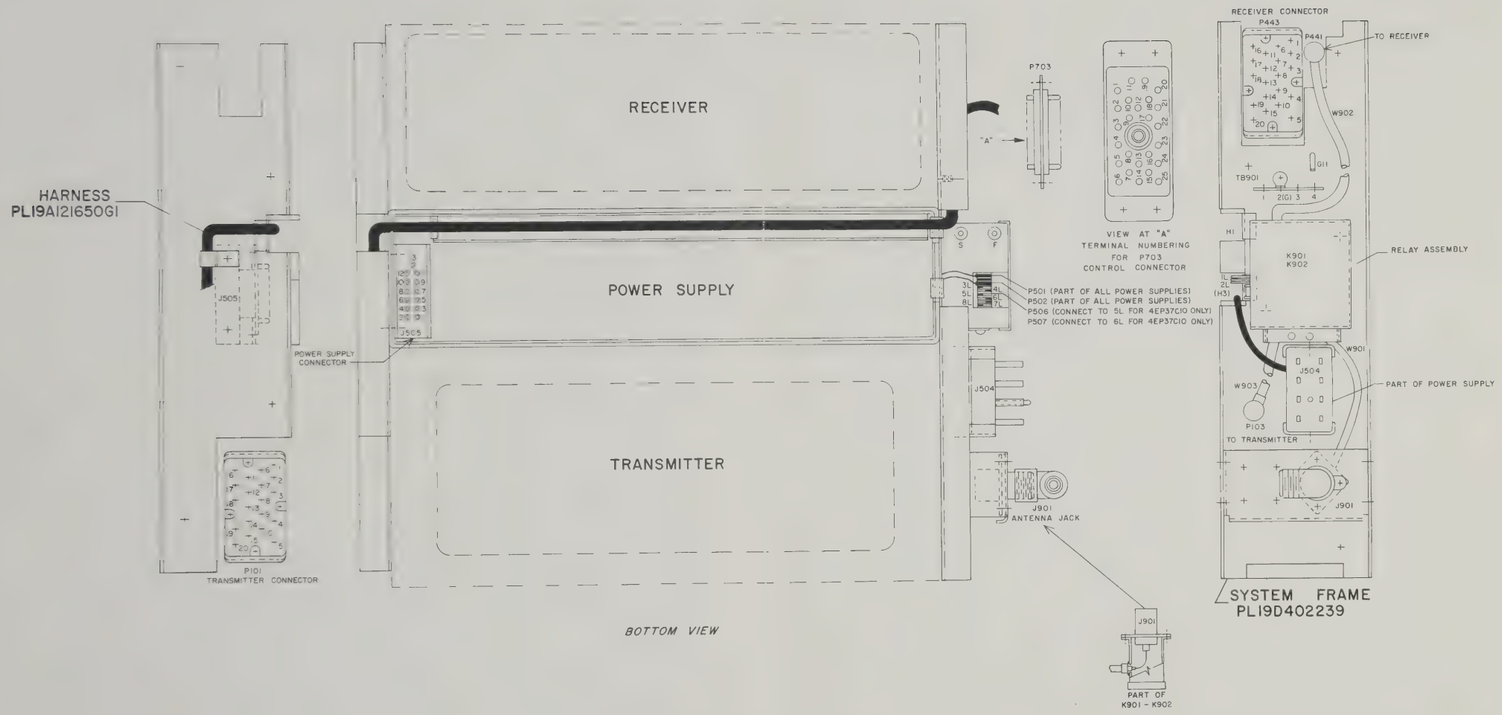
(DF-4070)

SCHEMATIC & INTERCONNECTION DIAGRAM

MASTR CONTROL UNIT, MODELS 4EC59A10-25

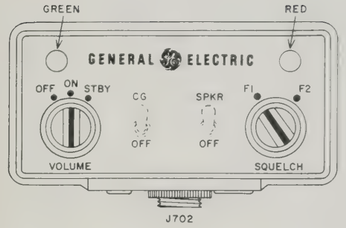
Issue 14

SYSTEM FRAME
AND HARNESS

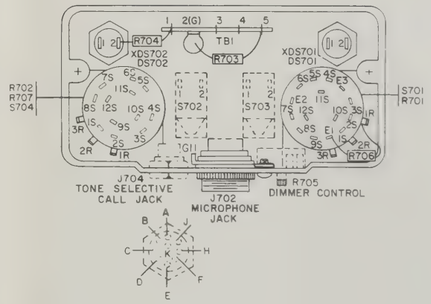


BOTTOM VIEW

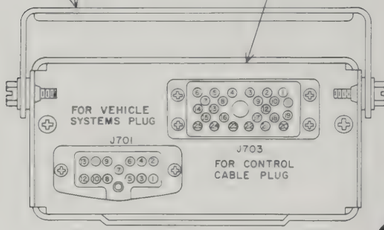
CONTROL UNIT
FRONT VIEW



CONTROL UNIT
BACK VIEW



MODIFICATION KIT
19A121469
FOR
TRUNK MOUNT UNITS
INCLUDES:
MOUNTING PLATE
MOUNTING BRACKET



CONTROL UNIT

SYMBOL	FUNCTION
R702	VOLUME CONTROL
R703	SQUELCH CONTROL
J701	TRUNK MOUNT SYSTEMS PLUG
J703	SPEAKER JACK
S701	HANDSET HOOK SWITCH
R705	[illegible]
R706	[illegible]

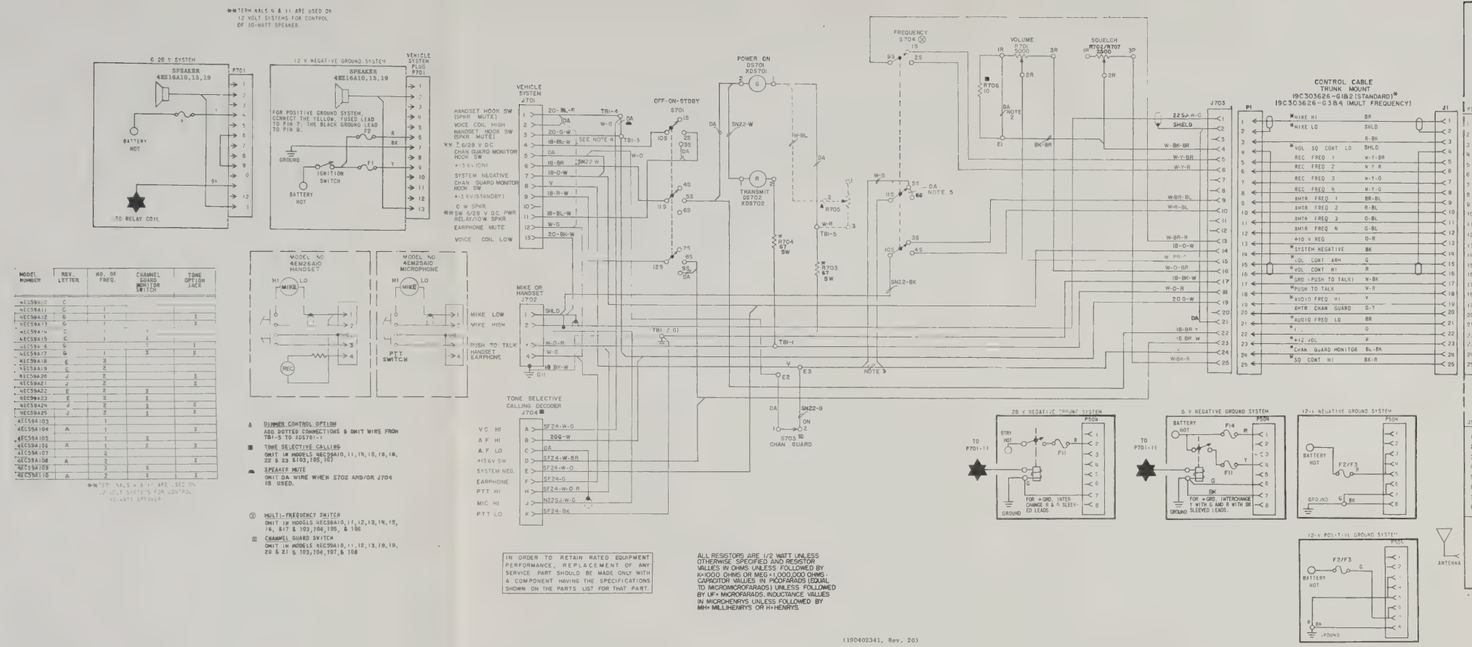
OUTLINE DIAGRAM

MASTR CONTROL UNIT
MODELS 4EC59A10-25

(19D402582, Rev. 3)

(19C303800, Rev. 1)

CONTROL UNIT



MODEL NUMBER	REV. LETTER	NO. OF FREQ.	CHANNEL GUARD MONITOR SWITCH	TONE CALLING
*4EC59A12	C	1	-	-
*4EC59A11	C	1	-	-
*4EC59A12	G	1	-	X
*4EC59A13	G	1	-	X
*4EC59A14	C	1	-	-
*4EC59A15	C	1	-	-
*4EC59A16	G	1	-	X
*4EC59A17	G	1	X	X
*4EC59A18	E	2	-	-
*4EC59A19	E	2	-	-
*4EC59A20	J	2	-	X
*4EC59A21	J	2	-	X
*4EC59A22	E	2	X	-
*4EC59A23	E	2	X	-
*4EC59A24	J	2	X	X
*4EC59A25	J	2	X	X
4EC58A03		1	-	-
4EC59A04	A	1	-	X
*4EC59A05		1	X	-
4EC59A06	A	1	X	X
4EC59A07		2	-	-
4EC59A08	A	2	-	X
*4EC59A09		2	X	-
*4EC59A10	A	2	X	X

**ITEM NOS. 9 & 11 ARE USED ON 12 VOLT SYSTEMS FOR CONTROL OF 10-WATT SPEAKER.

*ITEM NOS. 9 & 11 ARE USED ON 6 OR 12 VOLT SYSTEMS FOR CONTROL OF 10-WATT SPEAKER.

A DIMMER CONTROL OPTION
ADD DOTTED CONNECTIONS & OMIT WIRE FROM TB1-5 TO J2(J701)-11

■ TONE SELECTIVE CALLING
OMIT IN MODELS 4EC59A10, 11, 19, 16, 18, 19, 22 & 23 &193,105,107

▲ SPEAKER MUTE
OMIT DA WIRE WHEN S702 AND/OR J704 IS USED.

Ⓧ MULTI-FREQUENCY SWITCH
OMIT IN MODELS 4EC59A10, 11, 12, 13, 14, 15, 16, &17 & 103,104,105, & 106

▣ CHANNEL GUARD SWITCH
OMIT IN MODELS 4EC59A10, 11, 12, 13, 18, 19, 20 & 21 & 103,104,107, & 108

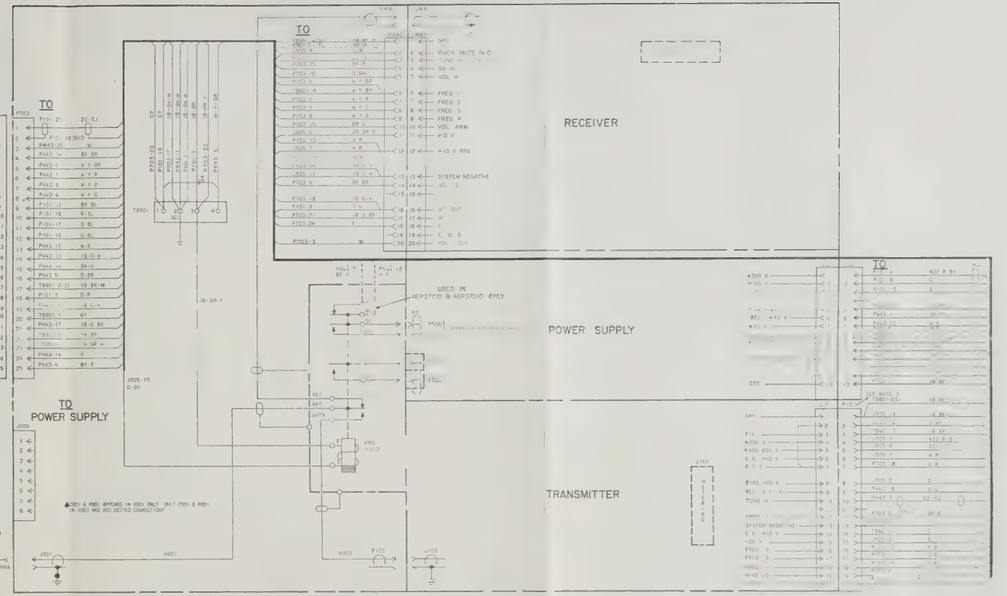
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

(19D403341, Rev. 20)

(RC-1186S)

SYSTEM FRAME AND HARNESS


RECEIVER
POWER SUPPLY
TRANSMITTER
TO POWER SUPPLY
USED IN 4EP37C01 & 4EP37D01 ONLY
A901 & P901 APPEARS IN K001 ONLY. OMIT C901 & P901 IN K003 AND K02 DOTTED CONNECTIONS
ANTENNA

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE [illegible]

(19D402378, Rev. 22)

NOTES:
1. ALL WIRES ARE STRAIGHT EXCEPT AS OTHERWISE SHOWN.
2. SEE 19D402378 FOR ORIENTATION AND LOCATION.

SCHEMATIC & INTERCONNECTION DIAGRAM

MASTR CONTROL UNIT, MODELS 4EC59A10-25

Issue 14

PRODUCTION CHANGES

ipment to improve performance or to simplify circuits are
evision Letter", which is stamped after the model number of
ision stamped on the unit includes all previous revisions.
List for descriptions of parts affected by these revisions.

259A12,13,16,17,20,21,24 and 25
ompatible with Universal Selective Calling decoder. Changed

259A12,13,16,17,20,21,24 and 25
speaker minimum audio level when using Universal Selective
ecoder. Changed R706.

259A18,19,22 and 23
259A20,21,24 and 25
power supply switching noise from modulating transmitter.
lack wire from ground lug TB1-2 (other end connected to
and connected it to microphone jack J702-1.

259A10,11,14 and 15
259A18,19,22 and 23
259A12,13,16 and 17
259A20,21,24 and 25
brate switch with improved reliability. Changed S701.

259A10, 11, 14, 15
259A18, 19, 22, 23
259A12, 13, 16, 17
259A20, 21, 24, 25
microphone jack, added #18 BK-W wire from TB1-2 (G)
d changed J702.

259A10, 11, 14, 15
259A18, 19, 22, 23
259A12, 13, 16, 17
259A20, 21, 24, 25
ontrol unit housing from metal to LEXAN®.

259A18, 19, 22, 23
259A20, 21, 24, 25
e Channel Guard decode function on all channels. Added
om S706-9S to -10S and from S706-10S to -11S.

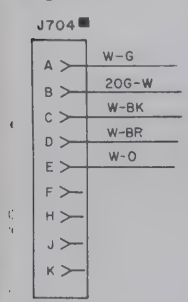
59A20, 21, 24, 25

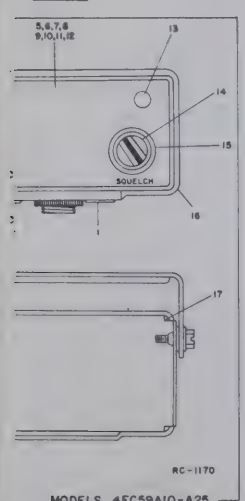
259A12, 13, 16, 17
audio output level at minimum volume control setting.
706.

259A12, 13, 16, 17
e hi, PTT, earphone and ground to Tone Option

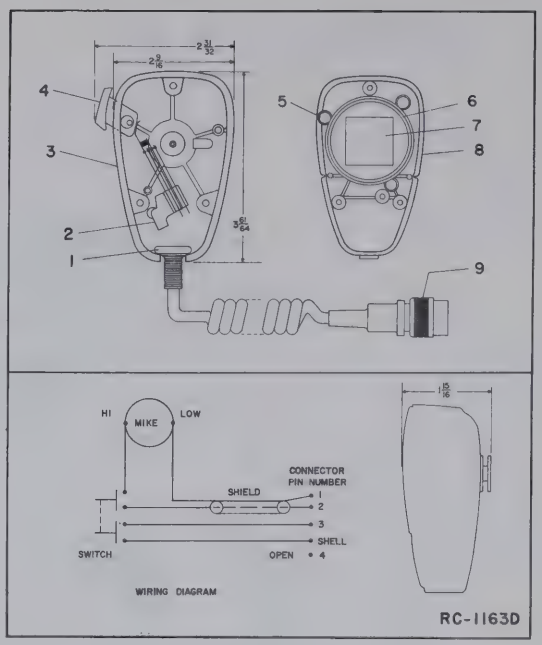
259A20, 21, 24, 25
e hi, PTT, earphone and ground to Tone Option

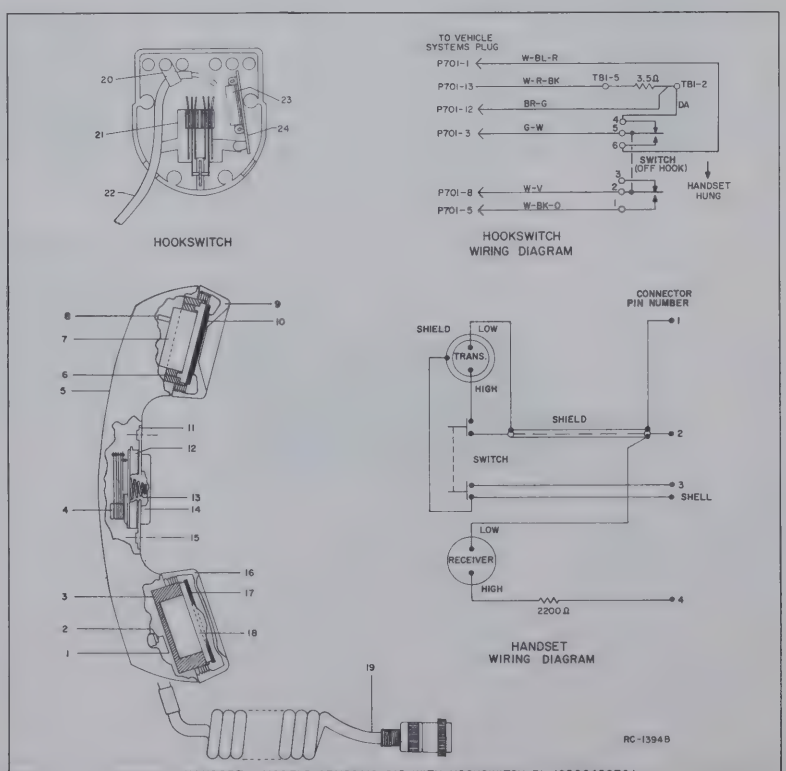
Diagram was:





MODELS 4EC59A10-A25





HANDSET - MODELS 4EM26A10,C10 WITH HOOKSWITCH PL-19B204867G1

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communications Equipment Sales Office of the General Electric Company.

PARTS LIST

LBI-3513J

CONTROL UNIT
MODELS 4EC59A10,11,14,15,19,20,23 STANDARD
MODELS 4EC59A12,13,16,17,20,21,24,25 SELECTIVE CALL
SO13
ASSOCIATED ASSEMBLIES

SYMBOL	GE PART NO.	DESCRIPTION
		CONTROL UNIT 19D602203G10-25
		- - - - - - - - INDICATING DEVICES - - - - - - -
DS701 and DS702	19B301133P1	Light, indicator: miniature, 6 v; sim to GE Type 1788.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - -
J701	19C303576P1	Socket, phone: 13 contacts rated at 5 amps max.
J702*	19A116061P1	Connector, chassis: 6 female contacts. Is Models 4EC59A10, 11, 14, 15 earlier than REV B; Is Models 4EC59A12, 13, 16, 17 earlier than REV D; Is Models 4EC59A18, 19, 22, 23 earlier than REV C; Is Models 4EC59A20, 21, 24, 25 earlier than REV E.
	7117934P3	Connector, chassis: 6 female contacts; sim to Amphenol Type 91-PC6F.
J703	19D403680P1	Connector, phone: 25 contacts rated at 5 amps max
J704	19B316379G1	Jack assembly: 9 female contacts rated at 5 amps at 900 VRMS; sim to Winchester MS9-LAJ.
		- - - - - - - - RESISTORS - - - - - - - -
R701		(Part of S701).
R702	19B209134P3	Variable, carbon film: 2500 ohms ±10%, 1/2 w; sim to Allen Bradley LC(2500).
R703 and R704	5493035P19	Wirewound, ceramic: 67 ohms ±5%, 5 w; sim to Hamilton Ball Type HM.
R706*	3A779100K	Composition: 10 ohms ±10%, 1/2 w. Is Models 4EC59A12, 13, 16, 17 earlier than REV F and Models 4EC59A20-25 earlier than REV H.
	3A779250K	Composition: 56 ohms ±10%, 1/2 w. Is Models of REV A:
	3A779271K	Composition: 270 ohms ±10%, 1/2 w. Is Models earlier than REV A:
	2A779220K	Composition: 22 ohms ±10%, 1/2 w. (Part of S704).
R707		
		- - - - - - - - SWITCHES - - - - - - - -
S701*	19C307088P19	Switch/Resistor: Includes Switch, rotary, 3 poles, 3 positions, momentary shorting contacts, 250 ma at 500 VRMS; Resistor (R701), variable, 5000 ohms ±20%, 1/3 w max; sim to Mallory LC5E. Is Models 4EC59A10, 11, 14, 15 earlier than REV A; Is Models 4EC59A18, 19, 22, 23 earlier than REV B; Is Models 4EC59A12, 13, 16, 17 earlier than REV C; Is Models 4EC59A20, 21 and 24, 25 earlier than REV D:
	19C307089P1	Switch/Resistor: Includes Switch, rotary, 3 poles, 3 positions, non-shorting contacts, 250 ma at 500 VRMS; Resistor (R701), variable, 5000 ohms ±20%, 1/3 w max; sim to Mallory LC5E.
S702 and S703	5491189P25	Toggle: DPST, 3 amps at 250 VAC or 250 VDC; sim to Cutler-Hammer 8280K15.
S704	19C307089P22	Switch/Resistor: Includes Switch, rotary, 6 poles, 2 positions, momentary shorting contacts, 250 ma at 500 VRMS; Resistor (R707), variable, 2500 ohms ±10%, 1 w max; sim to Mallory LC2500.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7775500P9	Phen: 5 terminals.

SYMBOL	GE PART NO.	DESCRIPTION
XDS701 and XDS702	19D301123P2	Lamp, miniature: sim to Braks Series 121.
		MECHANICAL PARTS (SEE RC-1170)
1	8529P19C13	Plug button. (Used in Models 4EC59A10, A11, A14, A15, A18, A19, A22 and A23).
2	8529P5C13	Plug button.
3	19A121331G1	Mounting bracket.
4	19B301132P3	Lens cap: green translucent nylon.
5	RP343A23	Nameplate: etched aluminum. (Used in Models 4EC59A10 and A12).
6	RP343A31	Nameplate: etched aluminum. (Used in Models 4EC59A11 and A13).
7	RP343A26	Nameplate: etched aluminum. (Used in Models 4EC59A14 and A16).
8	RP343A34	Nameplate: etched aluminum. (Used in Models 4EC59A18 and A20).
9	RP343A09	Nameplate: etched aluminum. (Used in Models 4EC59A19 and A21).
10	RP343A25	Nameplate: etched aluminum. (Used in Models 4EC59A22 and A24).
11	RP343A73	Nameplate: etched aluminum. (Used in Models 4EC59A15 and A17).
12	RP343A67	Nameplate: etched aluminum. (Used in Models 4EC59A23 and A25).
13	19B201122P4	Lens cap: red translucent nylon.
14	19B304443G1	Knob: gray.
15	19C303413P1	Knob: VOLUME/SQUELCH.
16	19B201637G1	Casting.
17	19B204522P1	Mounting plate.
		ASSOCIATED ASSEMBLIES
	19A121469G1	Control unit modification kit (trunk mount).
	19D602238G1	12 volt vehicle frame.
	19D602239G2	6 and 28 volt vehicle frame.
	19A132644P1	Cover, wire channel (on systems frame).
	19C303452G1	Front casting (Front mount).
	19C303452G2	Front casting (Trunk mount).
P1	19C303626G5	Plug, male: includes connector 19D402609P3, cap 18C303209P2 and connector retaining screw 19A121444P2.
	403420GP3	Screw: 10-32 x 1-1/8 (Secures Front casting).
	5491643P2	Lock: Tale and Tense. (Part of Front casting).
	5491643P7	Cam. (Used with lock).
		OTHER CONTROL MODIFICATION KIT 19A131239G1
		- - - - - - - - RESISTORS - - - - - - - -
R705	19B209114P1	Variable, wirewound: 75 ohms ±20%, 3 w; sim to CTS Series 112.
		POWER CABLE ASSEMBLY 19C303601G1 (12 VOLT FRONT MOUNT) 19C303601G2 (12 VOLT TRUNK MOUNT)
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	19B209189P1	Connector, phen: 8 contacts rate at 15 amps at 1100 VRMS; sim to Beauchaine and Sons S-5401-76.
	19D402638P1	Cap, connector.
	19A115431P1	Connector retaining screw.
	7146477P3	Cable: 2 lengths, approx 9 feet long connected to pins 1 and 7.
	7146477P4	Cable: 2 lengths, approx 9 feet long connected to pins 4 and 6.
		POWER CABLE ASSEMBLY (6 VOLT THRU MOUNT) 19C303650G1
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	19B209189P1	Connector, phen: 8 contacts rate at 15 amps at 1100 VRMS; sim to Beauchaine and Sons S-5401-76.
	19D402638P1	Cap, connector.
	19A115431P1	Connector retaining screw.
	7146477P3	Cable: 2 lengths, approx 9 feet long connected to pins 1 and 7.
	7146477P4	Cable: 2 lengths, approx 9 feet long connected to pins 4 and 6.
		CONTROL CABLE ASSEMBLY 19C303628G1, G2 (1-FREQ) 19C303629G1, G4 (MULTI-FREQ)
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	19C303626G5	Plug, male: includes connector 19D402609P3, cap 18C303209P2 and connector retaining screw 19A121444P2.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1	19C303626G6	Plug, female: includes connector 19D402609P3, cap 18C303209P2 and connector retaining screw 19A121444P1.
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	19D402608P1	Connector, female phen: 25 contacts rated at 5 amps max.
	19D402609P3	Connector, male phen: 25 contacts rated at 5 amps max.
	19C303290P1	Cap, connector.
	19C303290P2	Cap, connector.
	7139880P1	Cable: 20 conductors. (When ordering specify length). (Used in 19C303629G1 and G2).
	7139880P9	Cable: 13 conductors. (When ordering specify length). (Used in 19C303629G3 and G4).

SYMBOL	GE PART NO.	DESCRIPTION
		POWER CABLE ASSEMBLY 19C303630G1 (28 VOLT FRONT MOUNT) 19C303630G2 (28 VOLT THRUK MOUNT)
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	19B209189P1	Connector, phen: 8 contacts rate at 15 amps at 1100 VRMS; sim to Beauchaine and Sons S-5401-76.
	19D402638P1	Cap, connector.
	19A115431P1	Connector retaining screw.
	7146477P3	Cable: 2 lengths, approx 9 feet long connected to pins 1 and 7.
	7146477P4	Cable: 2 lengths, approx 9 feet long connected to pins 4 and 6.
		POWER CABLE ASSEMBLY (6 VOLT THRU MOUNT) 19C303650G1
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	19B209189P1	Connector, phen: 8 contacts rate at 15 amps at 1100 VRMS; sim to Beauchaine and Sons S-5401-76.
	19D402638P1	Cap, connector.
	19A115431P1	Connector retaining screw.
	7146477P3	Cable: 2 lengths, approx 9 feet long connected to pins 1 and 7.
	7146477P4	Cable: 2 lengths, approx 9 feet long connected to pins 4 and 6.
		CONTROL CABLE ASSEMBLY 19C303628G1, G2 (1-FREQ) 19C303629G3, G4 (MULTI-FREQ)
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	19C303626G5	Plug, male: includes connector 19D402609P3, cap 18C303209P2 and connector retaining screw 19A121444P2.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1	19C303626G6	Plug, female: includes connector 19D402608P1, cap 18C303209P2 and connector retaining screw 19A121444P1.
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	19D402608P1	Connector, female phen: 25 contacts rated at 5 amps max.
	19D402609P3	Connector, male phen: 25 contacts rated at 5 amps max.
	19C303290P1	Cap, connector.
	19C303290P2	Cap, connector.
	7139880P1	Cable: 20 conductors. (When ordering specify length). (Used in 19C303629G1 and G2).
	7139880P9	Cable: 13 conductors. (When ordering specify length). (Used in 19C303629G3 and G4).

SYMBOL	GE PART NO.	DESCRIPTION
		VEHICLE SYSTEM CABLE KIT 19A121454G1 (12 VOLT VEHICLES) 19A121454G2 (6/28 VOLT VEHICLES)
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	19A121324G1	6/28 volt vehicle jumper. (Used in 19A121454G2).
	19A121429P1	Pin: 1/2 inch long.
	19A121441G1	Plug: 13 contacts.
	19C303574P1	Cover.
		FUSED LEAD ASSEMBLY 19A121316G1 (6A/12A VOLT) 19A131314G2 (3A/14A VOLT)
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	1R16P8	Cartridge, quick blowing: 5 amps at 250 v; sim to Littelfuse 312005 or Bussman MTH-5.
	19A115776P2	Fuseholder.
		INTERCONNECTION HARNESS ASSEMBLY 19A121650G1
		- - - - - - - - JACKS AND RECEPTACLES - - - - -
J505	19B204408G1	Plug, male: 13 pin contacts.
		- - - - - - - - PLUGS - - - - - - - -
P101	19C303508P1	Connector, phen: 30 contacts.
P443	19C303506P1	Connector, phen: 30 contacts.
P703	19D403404P3	Connector, phen: 25 contacts.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB901	7775500P10	Phen: 8 terminals.
	19A127541P1	Cap, connector.
	19A121444P2	Connector retaining screw.
	7146477P1	Cable: 2 lengths, approx 22 feet long connected to pins 1 and 7.
	7146477P3	Cable: 2 lengths, approx 22 feet long connected to pins 4 and 6.
		6/12, 12/28 VOLT RELAY ASSEMBLY 25-470 MHz 19B209445P1
		Includes J901, E901, P103, P441, W901-W903.
		6/12, 12/28 VOLT RELAY ASSEMBLY 25-470 MHz 19B209445P2
		Includes J901, E902, P103, P441, W901-W903.
		FUSE AND RELAY ASSEMBLY 7487950G9 (28 VOLT VEHICLE) 7487953G20 (6 VOLT VEHICLE)
		- - - - - - - - RELAYS - - - - - - - -
K1	7486315P1	Armature, enclosed: 6 VDC nominal, 36 ohms ±5% coil res, 1 form A contact rated at 15 amps; sim to EIM RO-108013-5. (Used in 7487953G09).
K3	7486315P3	Armature, enclosed: 28 VDC nominal, 300 ohms ±10% coil res, 1 form A contact rated at 15 amps. (Used in 7487953G19).
		12 VOLT FUSE ASSEMBLY 19B216031G4
	19D413045P3	Base.
	19D413046P1	Cover.
	19B205950P1	Fuse clip.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - FUSES - - - - - - - - - -
F2	1R11P6	Quick blowing: 25 amps, 250 v; sim to Bussman NON25. (Used with medium power transmitters).
F3	1R11P7	Quick blowing: 30 amps, 250 v; sim to Bussman NON30. (Used with high power transmitters).
		130 - 150.9, 406 - 420, 450 - 470 MHz ANTENNA MODEL 457132A13 (19A009699P13)
		- - - - - - - - MISCELLANEOUS - - - - - - - -
		Antenna: Includes stainless steel whip approx 20 inches long, 11 tip; whip socket; No. 6-32; set screw; rubber mounting gasket; antenna cable; cable adapter; PL-259 coaxial plug; sim to Antenna Specialists ASP6221GE or Danbury-Knudsen Type PA-35.
	549066894	Whip: stainless steel, approx 20 inches long; ball tip.
	549066995	Socket, whip: with (2) No. 6-32 set screws.
	549066996	Whip and whip socket: stainless steel whip approx 20 inches long with ball tip; whip socket with (2) No. 6-32 set screws.
		Cable, antenna: approx 15 feet long. Type RG-58/U. (Used with GE Dwg 2B2291 and GE Dwg 7105381P1).
	7105381P1	Adapter, cable: approx 1 x 7/16 inches dia; Type UG-175/U. (Used with GE Dwg 2B2291 and Type RG-58/U cable).
	2B229P1	Plug, coaxial: mic-filled insert, UHF contact. Signal Corps PL-259; sim to Amphenol 83-1SP. (Used with GE Dwg 7105381P2 and Type RG-58/U cable).
		25 - 50 MHz ANTENNA
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	749107491	Antenna: Includes stainless steel rod approx 85-1/2 inches long, ball tip; lockwasher; No. 10-32 hex nut; set screw; sim to Antenna Specialists ASP43BGE.
	7105230P3	Adapter, antenna: approx 2-5/16 inches long. (Used with GE Dwg 749107491).
	4033101G1	Antenna package: Includes base; adapter spring; cable and plug.
	7472880G5	Antenna base.
	747662304	Adapter spring.
	5492230P1	Cable, antenna: includes Type RG-58/U cable approx 36 inches long, PL-259 coaxial plug; mounting clip; ring tongue terminal; sim to Antenna Specialists 13A43.
	2B229P1	Plug, coaxial: mica-filled insert, UHF contact. Signal Corps PL-259; sim to Amphenol 83-1SP. (Used with GE Dwg 5492230P1).
	4EY98A1	Coil, loading: 25 to 33 MHz; sim to Antenna Specialists ASP6A7.
	19A121577G1	Antenna hook kit.
	7134724P1	Antenna hook.
		HANDSET MODEL 4EM62A10 MODEL 4EM62C10 (19D209100G1) (SEE RC-1294)
1		Self tap screw, bind head: No. 4 x 5/16. Shure Brothers 30C540C.
2		Cable clamp. Shure Brothers 53A532.
3		Shield. Shure Brothers RP18.
4		Switch. Shure Brothers RP81.
5		Case. Shure Brothers RP49. (Used in 4EM26A10).
		Case. Shure Brothers 21RP899F. (Used in 4EM26C10).

SYMBOL	GE PART NO.	DESCRIPTION
6		Adapter. Shure Brothers 65A230.
7		Magnetic controlled cartridge. Shure Brothers RP41.
8	3B7P222K	Composition: 2200 ohms ±10%, 1/2 w.
9		Receiver cap. (Part of item 5).
10		Washer. Shure Brothers 34A231.
11		Escutcheon. Shure Brothers 53A536A.
12		Actuator. Shure Brothers 53A556.
13		Spring. Shure Brothers 44A140.
14		Plunger bar. Shure Brothers RP85.
15		Flat head screw, socket cap: No. 4-40 x 1/4. Shure Brothers 30C537B.
16		Transmitter cap. (Part of RP49).
17		Washer. Shure Brothers 34A309.
18		Magnetic controlled cartridge. Shure Brothers RP83.
19	549066995	Cable and plug. Shure Brothers RP48. (Used in 4EM26A10).
	549066996	Cable and plug. Shure Brothers 21RP738F. (Used in 4EM26C10).
		HOOKSWITCH ASSEMBLY 19B204897G1
		- - - - - - - - MISCELLANEOUS - - - - - - - -
20	4029851P4	Cable clamp; sim to WEC Kramer 3/16-4.
21	19A121612P1	Holder and switch: thermoplastic case, contact rating 1 amp at 125 v.
22	19A121581G1	Cable: approx 8-1/2 feet long.
23	5493035P10	Resistor, wirewound, ceramic: 3.3 ohms ±5%, 5 w; sim to Hamilton Ball Type HM.
24	7775500P55	Terminal board, phen: 5 terminals.
		MILITARY MICROPHONE MODEL 41M25410 (19D209102G1) (SEE RC-1163)
1		Cable clamp. Shure Brothers 53A532.
2		Switch. Shure Brothers RP26.
3		Cane (back) and mounting button: plastic. Shure Brothers RP67.
4		Switch button: red plastic. Shure Brothers RP25.
5		Spring. Shure Brothers RP16.
6		Shield. Shure Brothers RP23.
7		Magnetic controlled cartridge. Shure Brothers RP51.
8		Case (front): plastic. Shure Brothers RP67.
9		Cable and plug: approx 6 feet long. Shure Brothers RP14.
		5 WATT SPEAKER 4EZ16A19 (19D602499G2)
C1	19B209233P1	Electrolytic, non-polorized: 25 µf ±20%, 25 VDCT; sim to Sprague 44DC.
LS3	19B209422P1	Permanent magnet: 3 inch, 3.2 ohms ±10% imp, 2.00 ohms ±15% DC res, 7.5 w max operating.
W1	19A121546G1	Cable assembly: approx 48 inches long, includes (2) 19A121429P1 pins.
		MECHANICAL PARTS
	19B216296G2	Speaker housing.
	19A121550G3	Cover.
	19A121521G1	Mounting support.
	549040T2G	Neoprene grommet. (Upper)
	19A115470P1	Rubber grommet. (Lower)

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. This revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Models 4EC59A12, 13, 16, 17, 20, 21, 24 and 25
To make compatible with Universal Selective Call[illegible]. Changed K706.

REV. B - Models 4EC59A12, 13, 16, 17, 20, 21, 24 and 25
To reduce speaker minimum audio level when using Universal Selective Calling decoder. Changed R706.

REV. A - Models 4EC59A18, 19, 22 and 23
REV. C - Models 4EC59A20, 21, 24 and 25
To reduce power supply switching noise from modulating transmitter Removed black wire from ground lug TB1-2 (other end connected to R706-1&2) and connected to 4647900P16.

REV. A - Models 4EC59A10, 11, 14 and 15
REV. B - Models 4EC59A18, 19, 22 and 23
REV. C - Models 4EC59A12, 13, 16, 17
REV. D - Models 4EC59A20, 21, 24, 25
To incorporate switch with improved reliability. Changed S701

REV. B - Models 4EC59A10, 11, 14, 15
REV. C - Models 4EC59A18, 19, 22, 23
REV. D - Models 4EC59A12, 13, 16, 17
REV. E - Models 4EC59A20, 21, 24, 25
To ground microphone jack, added #16 BK-W wire from TB1-2 (GD) to G11 and changed J702

REV. C - Models 4EC59A10, 11, [illegible]
REV. D - Models 4EC59A18, 19, 22, 23
REV. E - Models 4EC59A12, 13, 16, 17
REV. F - Models 4EC59A20, 21, 24, 25
Changed control unit housing from metal to LEXAN

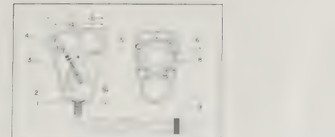
REV. E - Models 4EC59A18, 19, 22, 23
REV. G - Models 4EC59A20, 21, 24, 25
To provide Channel Guard decode function on all channels. Added jumpers from S706-9S to -10S and from S706-10S to -11S, rating 1 amp at 125 v.

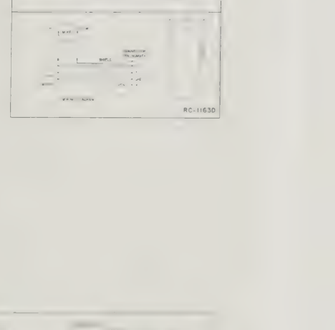
REV. H - Models 4EC59[illegible]
REV. F - Models 4EC59A12, 13, 16, 17
To reduce audio output level at minimum volume control setting. Changed R706.

REV. G - Models 4EC59A12, 13, 16, 17
Added mic hi, PTT, earphone and ground to Tone Option Jack J704.

REV. J - Models 4EC59A20, 21, 24, 25
Added mic hi, PTT, earphone and ground to Tone Option Jack J704.

Schematic Diagram was





— CONTROL UNIT MODEL 5 4EC59A10-A25 —

— HANDSET - MODEL 4EM62A10 (TO WITH HOOKSWITCH PL 19D[illegible]) —

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communications Equipment Sales Office of the General Electric Company.

MAINTENANCE MANUAL

LBI-3505

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GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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